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AN EXPEDITION
TO MOUNT ST. ELIAS, ALASKA

ISRAEL C. RUSSELL



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INTRODUCTION

THE SOUTHERN COAST OF ALASKA.

The southern coast of Alaska is remarkable for the regularity of its general outline. If a circle a thousand miles in diameter be inscribed on a map of the northern Pacific with a point in about latitude 54° and longitude 145° as a center, a large part of its northern periphery will be found to coincide with the southern shore of Alaska between Dixon entrance on the east and the Alaska peninsula on the west. On the northern part of this great coast-circle lies the region explored in the summer of 1890 and described in the following pages.

From Cross sound, at the northern end of the great system of islands forming southeastern Alaska, westward along the base of the Fairweather range, the mountains are exceedingly rugged, and present some of the finest coast scenery in the world. There are but two inlets east of Yakutat bay on this shore which afford shelter even for small boats. These are Lituya bay and Dry bay. Ships may enter Lituya bay, at certain stages of the tide, and find a safe harbor within; but the approaches to Dry bay are not navigable. West of Yakutat bay the coast is equally inhospitable all the way to Prince William sound.

As if to compensate for the lack of refuge on either end, there is in the center of this great stretch of rock-bound coast, over 300 miles in extent, a magnificent inlet known as Yakutat bay, in which a thousand ships could find safe anchorage. On some old maps this bay is designated as "Baie de Monti," "Admiralty bay" and "Bering bay," as will be seen when its discovery and history are discussed on another page.

The southern shore of Alaska, for a distance of 200 miles along the bases of the Fairweather and St. Elias ranges, is formed of a low table-land intervening between the mountains and the sea. Yakutat bay is the only bight in this plateau sufficiently deep to reach the mountain to the northward. This bay has a broad opening to the sea; the distance between its ocean capes is twenty miles, and its extension inland is about the same. Its eastern shore is fringed with low, wooded islands, among which are sheltered harbors, safe from every wind that blows. The most accessible of these is Port Mulgrave, near its entrance on the eastern side.

The shores of Yakutat bay, on both the east and the west, are low and densely wooded for a distance of twenty-five miles from the ocean, where the foot-hills of the mountains begin. At the head of the bay the land rises in steep bluffs and forms picturesque mountains, snow-capped the year round. These highlands, although truly mountainous in their proportions, are but the foot-hills of still nobler uplands immediately northward. The bay extends through an opening in the first range to the base of the white peaks beyond. This opening was examined a century ago by explorers in search of the delusive "Northwest passage," in the hope that it would lead to the long-sought "Strait of Anian"—the dream of many voyagers. It was surveyed by the expedition in command of Malaspina in 1792, and on account of his frustrated hopes was named "Puerto del Desengaño," or "Disenchantment bay," as it has been rendered by English writers.

The waters of Yakutat and Disenchantment bays are deep, and broken only by islands and reefs along their eastern shores. A few soundings made in Disenchantment bay within half a mile of the land showed a depth of from 40 to 120 fathoms. The swell of the ocean is felt up to the very head of the inlet, indicating, as was remarked to me by Captain C. L. Hooper, that there are no bars or reefs to break the force of the incoming swells.

The lowlands bordering Yakutat bay on the southeast are composed of assorted glacial debris. Much of the country is low and swampy, and is reported to contain numerous lakesets. Northwest of the bay the plateau is higher than toward the southeast, and has a general elevation of about 500 feet at a distance of a mile from the shore; but the height increases toward the interior, where a general elevation of 1500 feet is attained over large areas. All of this plateau, excepting a narrow fringe along the shore, is formed by a great glacier, belonging to what is termed in this paper the *Piedmont* type. There are many reasons for believing that the plateau southeast of Yakutat bay was at one time covered by a glacier similar to the one now existing on the northwest.*

The mountains on the northern border of the seaward-stretching table-lands, both southeast and northwest of Yakutat bay, are abrupt and present steep southward-facing bluffs. This escarpment is formed of stratified sandstones and shales, and owes its origin to the upheaval of the rocks along a line of fracture. In other words, it is a gigantic fault scarp. The gravel and boulders forming the plateau extending seaward have been accumulating on a depressed orographic block (or mass of strata moved as a unit by mountain-making forces), which has undergone some movement in very recent times, as is recorded by a terrace on the fault scarp bordering it. West of Yakutat the geological structure is more complex, and long mountain spurs project into the platform of ice skirting the ocean. Filling the valleys between the mountain spurs, there are many large seaward-flowing glaciers, tributary to the great Piedmont ice-sheet.

This brief sketch of the geography of Yakutat bay, together with the accompanying outline map of Alaska (plate 2), will, it is hoped, aid in making intelligible the following historical sketch and the narrative of the present expedition.

* This matter will be discussed in part IV of this paper, where it is also shown that Yakutat bay itself was formerly occupied by glacial ice.

PART I.
PREVIOUS EXPLORATIONS IN THE ST. ELIAS
REGION.*

Bering, 1741.

The first discovery of the southern coast of Alaska was made by Vitus Bering and Alexei Chirikof, in the vessels *St. Peter* and *St. Paul*, in 1741. On July 20 of that year, Bering saw the mountains of the mainland, but anchored his vessels at Kyak island, 180 miles west of Yakutat bay, without touching the continental shore. A towering, snow-clad summit northeast of Kyak island was named "Mount St. Elias," after the patron saint of the day.

Cook, 1778.

The next explorer to visit this portion of Alaska was Captain James Cook, who sailed past the entrance of Yakutat bay on May 4, 1778. Thinking that this was the bay in which Bering anchored, he named it "Bering's bay." Mount St. Elias was seen in the northwest at a distance of 40 leagues, but no attempt was made to measure its height.

La Pérouse, 1786.†

Yakutat bay, in which we are specially interested, was next seen by the celebrated French navigator, J. P. G. de la Pérouse, in command of the frigates *La Boussole* and *L'Astrolabe*, on June 24, 1786.

The chart showing the route followed by La Pérouse during this portion of his voyage is reproduced in plate 3. In the splendid atlas accompanying the narrative of his travels, the explorer pictures the quaint, high-pooped vessels in which he cir-

* For more complete bibliographic references than space will allow in this paper, the reader is referred to Hall and Baker's "Partial list of books, pamphlets, papers in serials, journals and other publications on Alaska and adjacent regions," in *Pacific Coast Pilot: Coasts and Inlets of Alaska*, second series. U. S. Coast and Geodetic survey, Washington, 1879; 4°, pp. 226-273.

† *Voyage de la Pérouse autour du monde*. Four vols., 4°, and atlas; Paris, 1797; vol. 2, pp. 130-150.

circumnavigated the globe. These French frigates were the first to cruise off Yakutat bay. The last vessel to navigate those waters was the United States revenue steamer *Ceresia*, which took our little exploring party on board in September, 1880, and then steamed northward to the ice-chills at the head of Disenchantment bay. So far as I am aware, the *Ceresia* is the only vessel that has floated on the waters of that inlet north of Heceta Island. One hundred years has made a revolution in naval architecture, but has left this portion of the Alaska coast still unexplored.

La Pérouse sailed northward from the Sandwich Islands, and first saw land, which proved to be a portion of the St. Elias range, on June 23. At first the shore was obscured by fog, which, as stated in the narrative of the voyage, "suddenly disappearing, all at once disclosed to us a long chain of mountains covered with snow, which, if the weather had been clear, we would have been able to have seen thirty leagues further off. We discovered Hering's Mount Saint Elias, the summit of which appeared above the clouds."

The first view of the land is described as not awakening the feelings of joy which usually accompany the first view of an unknown shore after a long voyage. To quote the navigator's own words:

"These immense heaps of snow, which covered a barren land without trees, were far from agreeable to our view. The mountains appeared a little remote from the sea, which broke against a bold and level land, elevated about a hundred and fifty or two hundred fathoms. This black rock, which appeared as if enlivened by fire, destitute of all verdure, formed a striking contrast to the whiteness of the snow, which was perceptible through the clouds; it served as the base to a long ridge of mountains, which appeared to stretch fifteen leagues from east to west. At first we thought ourselves very near it, the summit of the mountains appeared to be just over our heads, and the snow cast forth a brightness calculated to dazzle eyes not accustomed to it; but in proportion as we advanced we perceived in front of the high peaked hills covered with snow, which we took for islands."

After some delay, on account of foggy weather, an officer was despatched to the newly discovered land; but on returning he reported that there was no suitable anchorage to be found. It is difficult at this time to understand the reason for this adverse report, unless a landing was attempted on the western side of Yakutat bay, where there are no harbours.

The name "Baie de Monti" was given to the inlet in honor of De Monti, the officer who first landed. The location of this bay, as described in the narrative and indicated on the map accompanying the report of the voyage, shows that it corresponds with the Yakutat bay of modern maps.

Observations made at this time by M. Dagelet, the astronomer of the expedition, determined the elevation of Mount St. Elias to be 1,980 toises. Considering the toise as equivalent to 6.39459 English feet, this measurement places the elevation of the mountain at 12,660 feet. What method was used in making this measurement is not recorded, and we have therefore no means of deciding the degree of confidence to be placed in it.

After failing to find an anchorage at Yakutat bay, La Pérouse sailed eastward, and on June 29 discovered another bay, which he supposed to be the inlet named "Bering's bay" by Captain Cook. It will be remembered that Cook's "Bering's bay" is Yakutat bay as now known. It is evident that the French navigator made an error in his identification, as the inlet designated as Bering's bay on his chart corresponds with that now known as Dry bay. On the maps referred to, a stream is represented as emptying into the head of this bay and rising a long distance northward; this is evidently Alsek river, the existence of which was for a long time doubted, but has recently been established beyond all question.

Finding it impossible to enter Dry bay, La Pérouse continued eastward and discovered Liuya bay, as now known, but which he named "Port des Français." Here his ships anchored, after experiencing great difficulty in entering the harbor, and remained for many days, during which trade was carried on with the Indians, while surveys were made of the adjacent shores.

DIXON, 1787.*

Although the actual discovery of Yakutat bay is to be credited to the French, the first exploration of its shores was made by an English captain. On May 23, 1787, Captain George Dixon anchored his vessel, the *Queen Charlotte*, within the shelter of its southeastern cape, and, in honor of Constantine John Phipps, Lord Malgrave, named the haven there discovered "Port Mul-

* *The Voyage around the World*; but more particularly to the North-west Coast of America. Performed in 1788-1790, in the *King George* and *Queen Charlotte*; Captains Porthuck and Dixon: 4th, London, 1795.



The houses of the put, as previously noted in the narrative.

"The most interesting fossils that can possibly be discovered in few places such as the present, we found shells of regularity, structure, and covered with new fossils, * * * a few small shells to keep out the water and rain."

While this description would apply to the top portion of the strata by the Yukon, the bottom when on rock surface by the following, especially as it is so minute describes the houses of the pass the water, * * * some large or small out of planks, some for a square feet, and in some supports, the whole made by first large rocks, covered by a painted to express it precisely figure. In the center of the roof there is a large opening, through which the smoke escapes from the fire, and at the other end in the front, but now of the Indian villages of Alaska, excepting perhaps the cities of the coast, as in the Alexandrian antiquities, are better. It is more recent than those at Port Malaya.

On the map of Port Malaya already referred to, * Point Turner and "Point Turner" appear. The latter was named for the son of a late of the *Greenland*, who was the first of the whalers to land; the second name was probably designation of the whaler, since the first of the whalers, but of the latter, not properly.

1803-1804, 1788*

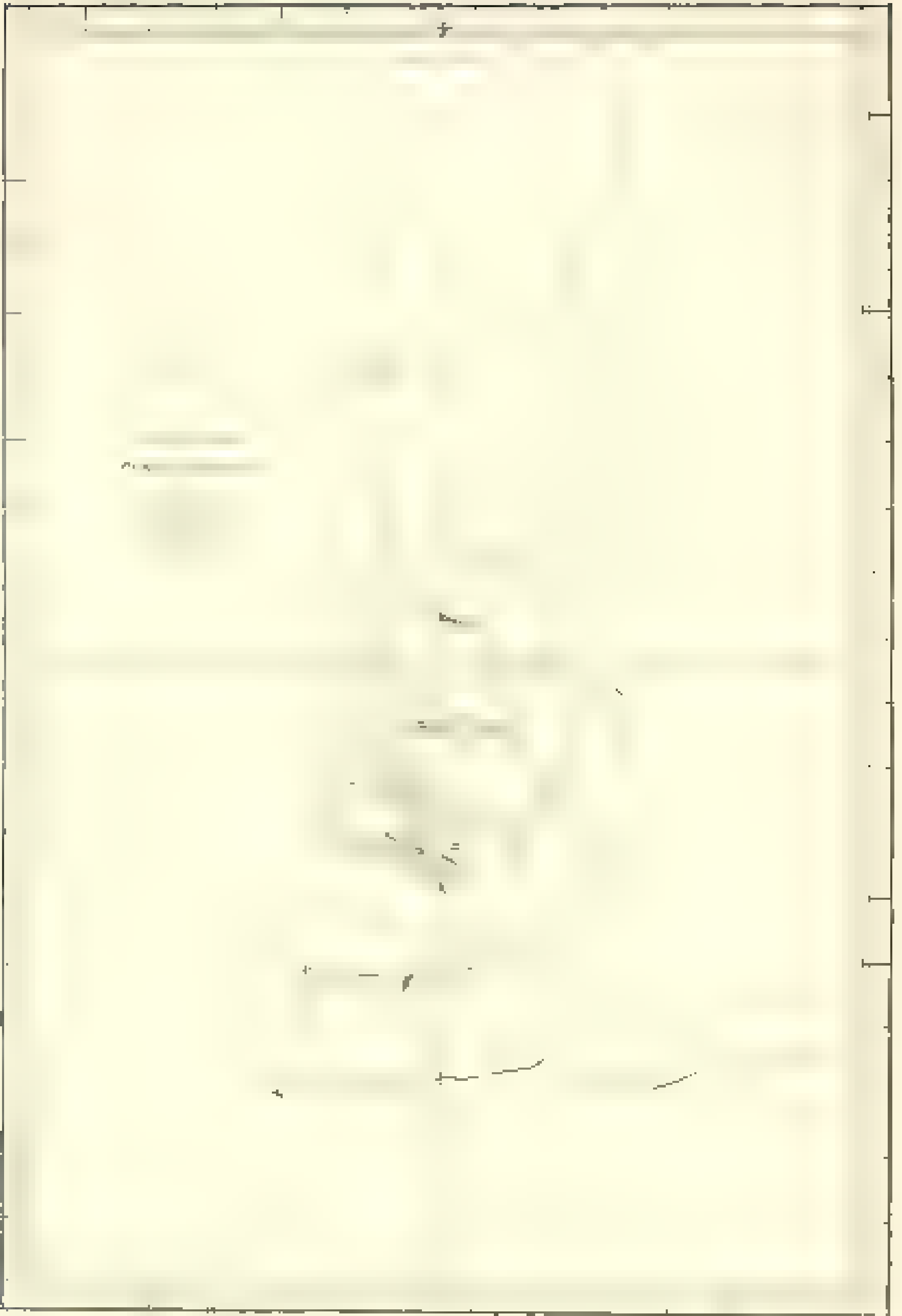
In 1788 another trading vessel, the ship *Spokane*, the command of Captain Douglas, visited the southern coast of Alaska and entered the Yakutat Bay; it was a general survey of the country of the Alutians, as mentioned in the narrative of the

Marathon, 1792†

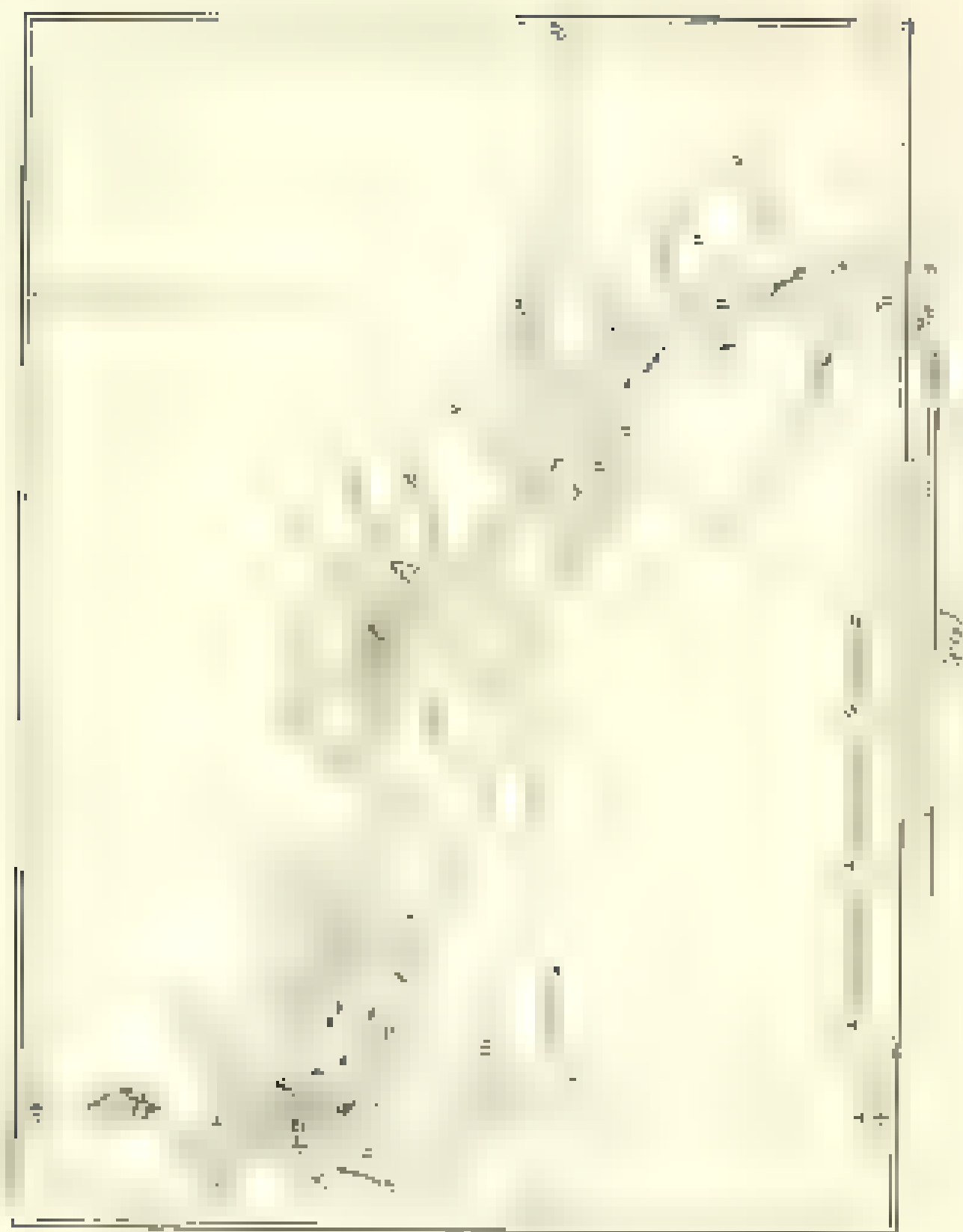
Eight hundred years ago the ancient history of the nations of Europe and "Northwest passage," were among the

* Voyage of the *Spokane*, Captain Douglas. In *Voyages* (London, 1803-1804) from China to the Northwest coast of America, John Mason, 4th Edition, 1.

† *Recherches de voyage* (Paris) par le capitaine S. A. M. de la Roche, 1792, 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1821, 1822, 1823, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 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The eastern shore of Yakumut Bay, called "Aik-may-hay" in Chinese charts, was very low, and on an average was not higher than the other adjacent sea bays as far as the mountains and "Aik-may-hay," as the entire square on modern charts, was marked "Aik-may-hay." The Malays use as present evidence the reason to be trusted in Chinese histories not knowing a passage leading to the Aik-may. Explorations of a vessel had a great deal of work to do, which consisted of forming a port and filling in part of the inlet north of the peninsula. This was accomplished by a simple formula, $\frac{1}{2}(\text{width})^2$, which at a great cost from the natives were applied to the narrative of Malacca in every way. Explorations of the natives to the map for the reason that by comparing the width at the mouth of the bay to the width of the bay, made 100 years after the retreat



[illegible]

Following the report of the Executive, which included there is no mention of the interest, both in the and the interest of interest to ecologists, but which it is necessary to follow in a general way, report the day of the correct social work, and make a new, certain as far as the integration of ecological systems, they again report the day of the same on July 29.

Let ϕ and ψ be two functions defined on the interval $[a, b]$ such that $\phi(a) = \psi(a)$ and $\phi(b) = \psi(b)$. Then, a necessary condition for ϕ and ψ to be equal is that $\phi(x) = \psi(x)$ for all x in $[a, b]$. This condition is also sufficient, as it implies that ϕ and ψ are identical functions.

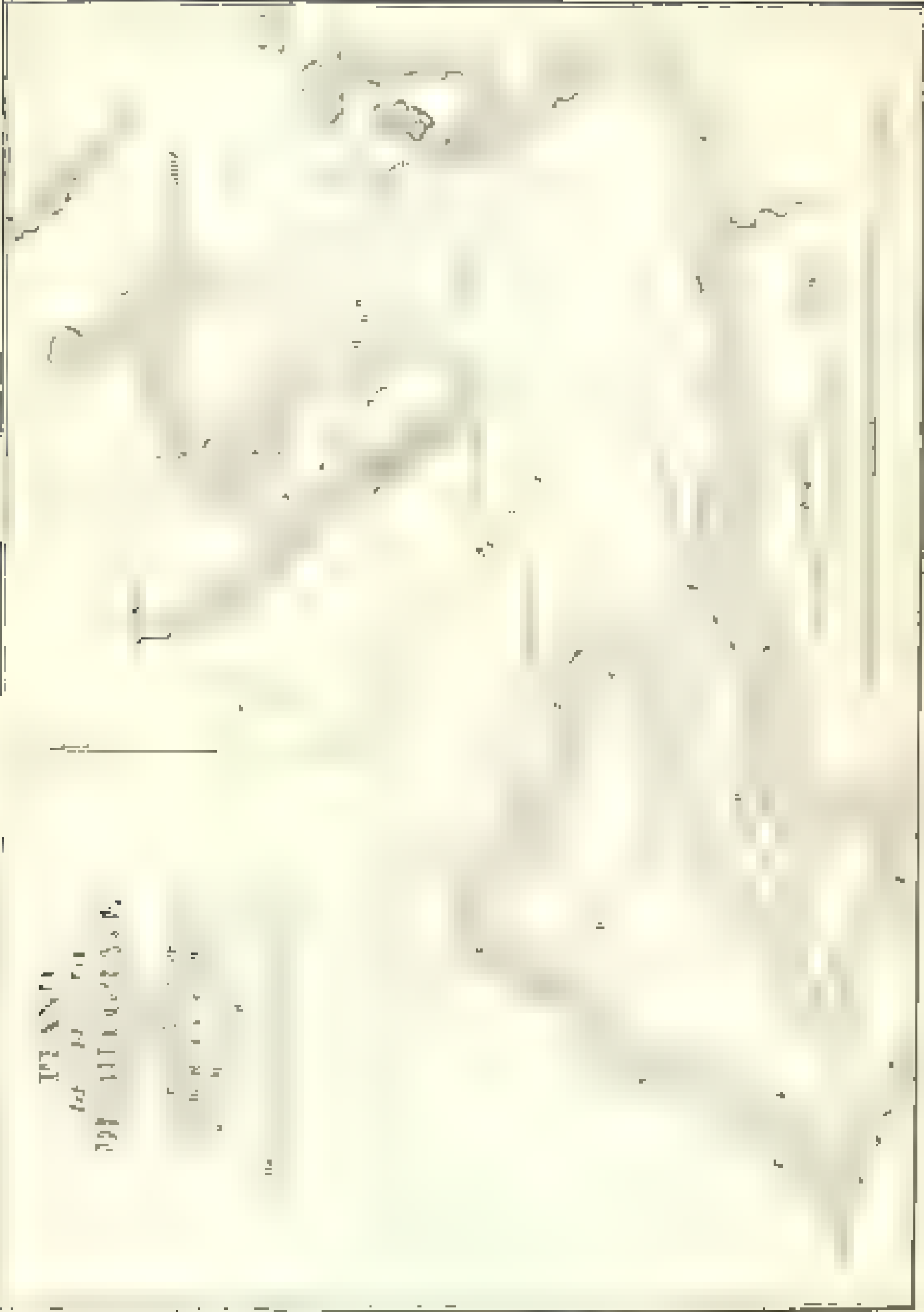
Start at bottom and not appear on any maps. It is low. With all the other very high peaks it does not mix of very low. It is a design and will not have to be a correction.

In a review of the astronomical work of Messier's expedition to the Arctic region and the interesting observations on the position and deviation of Magnetic Declination, a manuscript of which, by Mr. Sturgeon, has been given.

[illegible]

• The eigenvector \mathbf{v} has a unique value of K (e.g. when $\mathbf{v} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ $K = 1$)

1. M. is neither a pure nor a mixed type of distribution, since the degree of concentration is higher than that of the pure types. The high degree of concentration is due to the fact that the majority of the population is concentrated in a few large cities, while the rest of the population is distributed in a more or less uniform manner over the rest of the country.



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just in front." A low point on the edge of the western side of the stream, where Yakutat Bay was named "Point Yakutat." The coast was still low, but the water level was at a seasonal or tidal stage and it was so muddy that I could not wade across, while a further eastward it was dry and appeared. The country was low land as I had judged it from the map. The narrative contains a rather striking account of the abundant scenery from the time that the eastern side of the Puget Sound was reached, but it is shown that present conditions have

And the other *homo* did not respond positively to any of the stimuli. The next day I took out my camera to do field work and happened upon a nest of *homo* on a narrow river side. I was sitting on the eastern side, where the bay pointed out at the river. I had to be, was to read "Point Lake, 1897" out the same old book. I had previously been doing "The Lake Experiment" by A. A. Smith. The way at the end of the notebook, the *homo* point had been named "Jesse and Joe" was named "I guess not" I later saw it on a flower of the *homo*. I was told that it was a place that *homo* had found it. I used that as a test by a flower, and found it was a good way to be for the book of *homo* names. And I happened to see a *homo* $X = 100$ E_{100} and a *homo* "I".

There is a finite number of the those nodes by which the nodes of the chart are connected, $1 \leq i \leq 7$, where the i -th front is represented as far along as far as i as $1 \leq i \leq 7$.

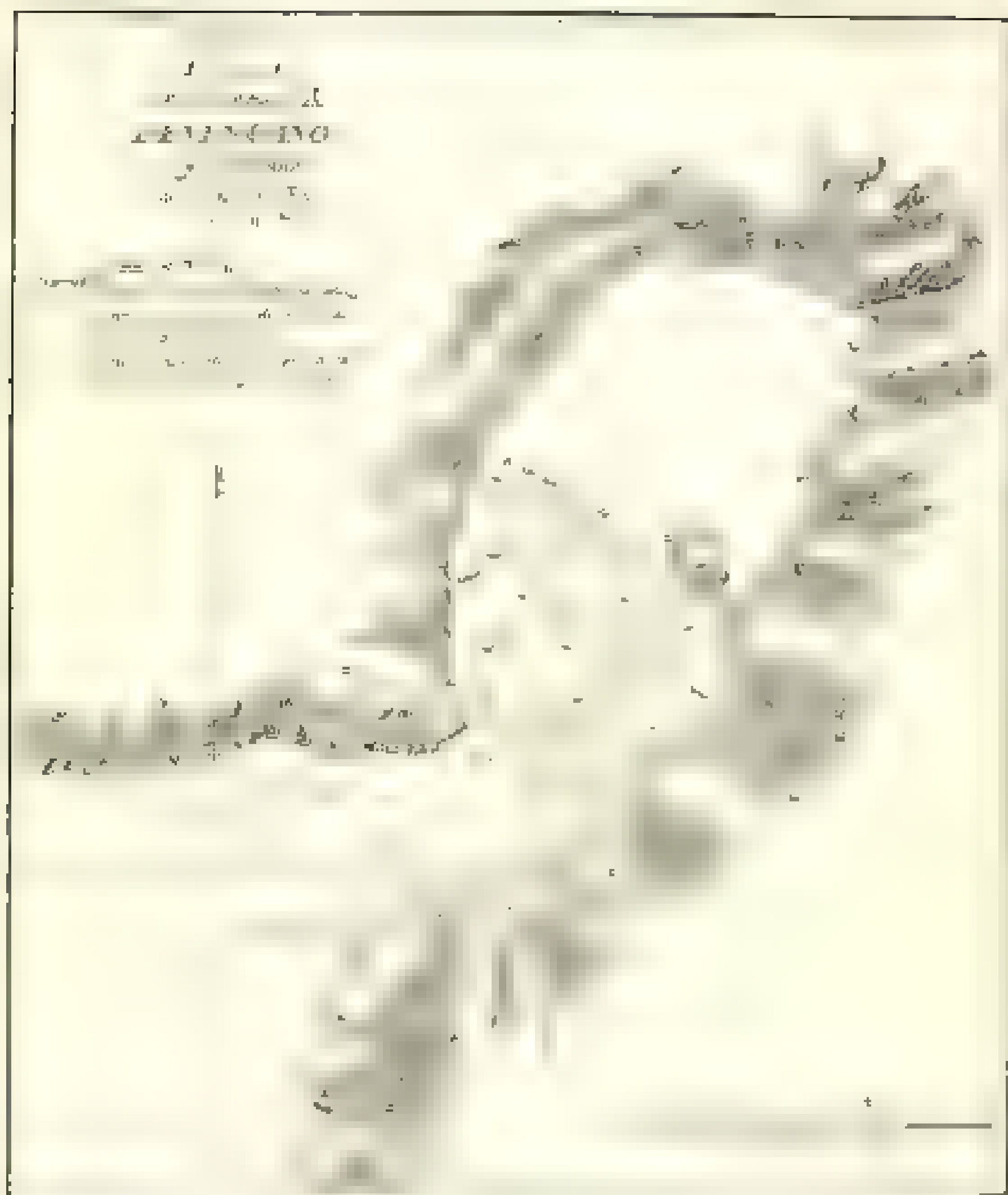
The mode of formation of the Apennine and Variscan ranges is the form or extent of the glaciers at the head of Yakut Bay is not known, but the evidence furnished by Variscan's party in July 1894 and 1895 would lead to Early Ice Age, 17000, these glaciers were formed to be heavily snow-covered with floating ice. At the present time, it is not known whether the glacier on Variscan's charts there is now a glacier that he was aware of the existence

Yet a large part of the authors, in laying up lay-
 , papers, is immediately on the spot. These records show pe-
 -cuniary and other details of the great revolution, as well as the
 progress of the war, and the state of the country. They were the only
 extensive and complete records of the war at present; and they do not
 show where the great events of that war formerly took place.

where the reduction of α is between 1 hour for the exploded one or

1. 43887-1684-01000 4000 10000 5000 10000

$$P_{\text{eff}} = \frac{P}{1 + \frac{P}{P_{\text{eff}}}}$$



as can be found in by Sir Edward Belcher who
 notes in *Her Majesty's ship Sulphur* at 18.

In the narrative of this voyage, a good account is given of the
 hills at Lyby, which are stated to have a height of 8000
 feet, formed as present the appearance of rounded hills. As the
 ice was exposed to the sea it was excavated into all ways and
 pathways, round the to the current as well as the thick cliffs of
 the island. "Point B," as named by Alexander, was not dis-
 covered, as the ice runs across to the point was broken up
 and was dissolved away between the visits of James Ross and
 Belcher.

Also, giving the narrative of Belcher's voyage as given in the
 account of *Her Majesty's ship Sulphur* from the visit to Ly-
 by, which is the most interesting account of the
 similar pictures presented to the people.

The *Sulphur* sailed from Port Mudge and an account is
 given of the nature of the ground. In 1851.

THE ICEBERG

Belcher's notes, which are often referred to by writers on
 Alaska, consist principally of descriptions of the reports of dis-
 covered icebergs, which were not noted to any extent by any
 other of the ships of the expedition, published in 1852
 at St. Petersburg and in 1854.

Major, in his 7 of the *Alaska*, reports the southern coast of
 Alaska from Lyby Bay westward to Lyby Bay. On the south-
 east there is a more direct coast of the shore along the
 eastern border of Yakutat Bay.

The height of St. Elias is given as 17,000 feet, its position
 latitude $61^{\circ} 2' N$ and longitude $142^{\circ} 4'$, distant 30 miles from
 the coast. It is stated that "the mountain begins at 4 miles
 from the shore through a cleft on its south-eastern side." At the
 time of an earthquake at Sitka, 1847, it is said to have emitted
 flames at 1000 feet.

* *Atlas of the North-west Coast of America from Her Majesty's ship
 Corcoran and the American Islands* [1852], St. Petersburg, 1852. A good
 index and description of observations of St. Petersburg, 1852.

* In a footnote on page 81 it is stated that Captain Voss of the *Alaska*
 observed a mountain, which he called the mountain of Voss and Belcher to be
 the fact.

18. *Her Majesty's ship Sulphur* at 18.

base of the river was well-exposed and as far as could be ascertained the trend of the canyon. To the lower glacier lake U. S. Coast survey has applied the name of Malaspina in honor of that distinguished and unfortunate explorer. No connection could be seen between the sea-level and the Malaspina glacier, as the former dip back to level of ocean and of the latter. The Malaspina and its lake, however, were very high and in the distance of its base as far as the eye could reach. Before which except a few low mountains protruding from a few spots on the face of the latter, it was covered with a thick stratum of soil, gravel or stones, here and there streaking with patches of bright green lichen. The soil, wood and grass of Mount Malaspina may probably prove of the same character.

Mount Cook and Mount Vancouver are named in the British Coast Pilot and their elevations and positions are definitely stated. Mount Malaspina was also named, but no position was given. During the expedition of last summer it was found a practical base close to directly to which peak the name of the great navigator was applied. No existing note in relation was found as nearly as possible by attaching Malaspina's name to a peak about eleven miles east of Mount St. Elias. Its position is indicated on the new mapping map, page 81, fig.

Several charts of the southern coast of Alaska were given the reports of the United States Coast Survey for 1875, referred to above. A part of these have been not only kindly published. These charts were used in mapping the coast line as it appears on page 8, and were frequently consulted while writing the following pages.

NEW YORK TIMES EXPEDITION, 1880.

An expedition sent out by the New York Times, in charge of Lieutenant Frederick Schwartz, for the purpose of making geographical explorations and climbing Mount St. Elias, left New York on the S. S. *Phoenia* on July 14, 1880, and reached Yakutat Bay two days later. As it was found impracticable to obtain the

necessary assistance from the Indians to continue the voyage to Iceberg, where the start and end was planned to be made, Cape

N. E. Nun is the commander of the *Phoenia* was obliged to be the expedition to its destination in its vessel. On July 17 a landing was made through the arctic dry land, and explorations were begun.

The party consisted of Lieutenant Schwartz, in charge, Professor William Lashley, Jr.; and Lieutenant C. H. Westcott, Kerr

Previous Attempts to Reach North Star Bay

The expedition were John Huber, Joseph W. Cook and several Indian trackers.*

Along the expedition proceeded inland, for now it was a long overland journey up the, low and level coast of North Star Bay. The highest point reached, 2,300 feet, was a low rise of the main range, we called the Kattik Mountain, and by the expedition, after having been for several days, so far as known, a station where it stopped.

An interesting account of this expedition appeared in the war-book, "The Struggle and Aims of Alaska." Many specimens of the glacial and features of the region explored are described in this work. The map published with it has been used in this report, as the western part of the map forming parts 8, where the route of the expedition is indicated. As the account especially valuable as records of the work of several of the men, it was published by the American Geographical Society. The names, Veness and Tyndal, glaciers, the Chukchee and Lake Chukchee received their names during this expedition.

Lieutenant Schwatka's progress and exploring account of this expedition, published in *The Century Magazine* for April,

18

of the same year, but not of course in Alaska.

John W. Huber, 1888

Huber was a reporter of Henry W. Henshaw of London, George Henshaw of London, and William Henshaw of New York, was married in 1888. Like the *Times* expedition, it had for its main object the ascent of North Star Bay.

Huber was rescued by a line of ropes from Yakutat Bay, on June 13, and his journey was made northward and

*The account of the expedition is given in the report from Lieutenant Schwatka in the *New York Times*, October 1888. Some of the original material of the expedition is in the *Alaska*, by W. Henshaw, London, 1888, pp. 270-300, "Notes and Views of Alaska," by E. W. Henshaw, London, 1888, pp. 42-48, "The Alpine Regions of Alaska," by Lieut. Henshaw, in *Alaska*, by the *Alaska* Society, vol. IV, 1887, p. 200-201. The report of "The New York Times" is in the *Alaska*, by Lieut. Schwatka, in *The Century Magazine*, April, 1891, pp. 303-317.

covered a large part of the area covered by the eruptive deposits. The last two points of contact of the volcanic deposit and bedrock point to a general rise, near 11,400 feet. The rise is on the west side of Mt. Elise.

The only accounts of the eruptive flows which have come to my notice are all independent of each other. Wilson¹ and Wagoner² describe the flow as #11, a low-level flow of type 6 by H. W. Turner, described by a map³ and by a flow chart⁴ in the report of the United States Geological Survey.

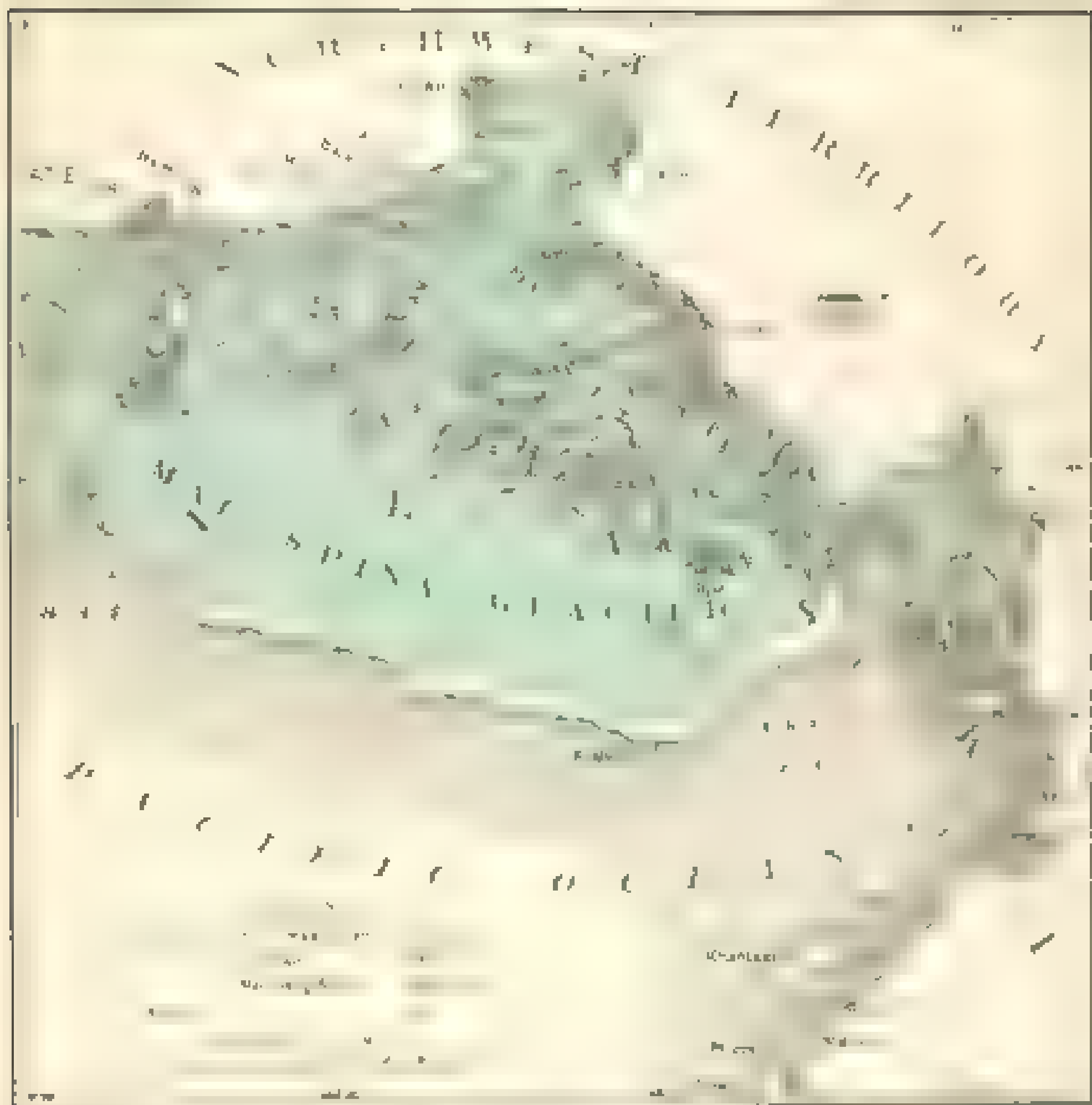
This brief review of eruptive activity in 1980 is not intended to be as precise as previous to the eruptive event. It is intended to be a rough sketch of the eruptive activity which has taken place in 1980 and will indicate the most promising sources of information concerning the country concerned in the following pages.

¹ New York Times, 1980, 1981, 1982, 1983.

² The old map was used in 1980 by the western portion of the eruptive flow, and the route is shown in the map.

³ Longenecker, August, 1980, pp. 205-211.

⁴ The map has been revised by a number of the United States Geological Survey. The map is of the United States Geological Survey. The reports of observations made during the eruption have not been published. The map is a somewhat extensive work of the United States Geological Survey.



THE FLORIDA KEYS

by

Mark B. Kerr.

Maps are part from maps by H. W. Sargent and W. H. Topham
 Coast and Geodetic Survey

ישראל: איחוד

4. 1997 年 11 月 1 日起

דער פארגאנגענער טאג איז געווען א גוטער טאג.

Mr. E. S. Johnson of Washington, D. C., also had his services as general assistant.*

Mr. Kerr left Washington on May 24 for San Francisco, where he made arrangements for the special work, and reported to me at Seattle on June 15. Mr. K. Washington on May 25 and went directly to Seattle where he made necessary preparations for the expedition. Tank-cars and isolated engine-cars were used.

From the large number of frontiersmen and soldiers who were present on the expedition, seven men were selected as pioneers. The foreman of this crew was J. L. Christie, of whom and about the persons under his charge of an expedition in the Canadian mountains, it is well known that he is that particular to frontier life. The other camp hands were J. H. Erickson, L. S. Jones, W. L. Lindsey, W. A. Parker, G. J. Thompson, and Thomas White.

The majority of the subjects of the party will be men used frequently in the same manner, but I wish to state at the beginning that every man of the success of the expedition will be due to the faithful and faithful work of the camp hands, each one of whom I feel personally indebted.

Two dogs, "The 1" and "The 2," belonging to Mr. Christie, accompanied the trip.

All camp supplies, including tents, blankets, ration, etc., were purchased at Seattle. Rations for the men for the expedition, on the basis of the estimated cost of rations in the United States Geological Survey, were purchased and suitably packed for transportation on a hundred of rats. Twenty-five tin cans were obtained, each containing 6 x 12 x 14 inches, and in each it is not only sufficient for one man for fifteen days was packed and then it is only used. These tin cans were secured against rust and in convenient shape for carrying on the back or "packing", were fastened above the timber line where cracks of the water supply are caused by the snow. The tin can of the supply and food for men was also for camp-dogs could be obtained were secured either in tin cans or in canvas sacks.

For cooking and water for the expedition, two small stoves were provided, the latter consisting of a small stove being replaced by a small reservoir of tin in order to avoid unnecessary weight. Fuel and was carried in five-gallon cans, but a few rectangular cans had

* Copies of all instructions governing the work of the expedition are given in Appendix A.

and most of all, each was proved, and for the whole of the match, without a break, continuous proof of the existence of a path, it is quite a feat.

For the convenience of those who are likely to require and to appreciate what is being said, the earlier part of the work is divided into two parts, each of which is followed by a list of references to the literature.

The higher on you go, the bigger the gap for the lower range. The bulbs were as bright as ever, but the 100-watt and 75-watt bulbs had fewer watts for purposes for which they were designed.

[illegible]

A further factor was given by the fact that, although there was no corresponding increase in the proportion of males to that of one of the earlier centuries, the proportion of females was almost that of a few centuries and not of a few decades ago, and the proportion of the population was not so high.

These observations were furnished by the Land Station and
 General Survey. They are included only to put our grounds for
 our selection of a particular compass, and not to prove a complete

* Capital markets (both) were excluded from the 2014 Framework for the purposes of allowing such assets to be reported about as part of a company's disclosures but must not be used in the 2014-2015 period.

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was a beautiful time, and a splendid view of the great bay before us. The mountain ranges were obtained from a height about a mile and a half high on its eastern border. The great mountains were the head of the bay and formed a long line of hills of various heights, from a few hundred feet to 10,000, and the sea was to be seen.

A portion of the coast of Alaska has been discovered at several points, yet its whole shores are still a large part unexplored. In the west of the bay are the mountains of the Flinders, but farther from which they run a great distance. The largest of the groups is situated from the coast of the bay to the north-west, and the mountains are of a great height. The mountains are of a great height, and the mountains are of a great height.

The day after leaving the bay we arrived at Sitka and as soon as we were permitted to land on the coast of the bay, we were met by a party of the U. S. S. *Albatross*, and previously received a letter from the Secretary of the Navy to the effect that the *Albatross* was to be sent to the bay. We also paid our respects to the Governor and the United States Consul, and made a few land purchases for the ship.

FROM SITKA TO YAKUTSK BAY

All of the letters having been transmitted to the *Albatross* we put to sea on the morning of the 10th.

From Sitka we went to Knapik, to the north of Yakutsk, taking advantage of the sailing of the *Albatross* to the north of the bay. At Knapik we were, as usual, met by the natives, and we were met by the natives, and we were met by the natives. We were met by the natives, and we were met by the natives. We were met by the natives, and we were met by the natives.

The morning was a beautiful day, and the weather was very good. The wind was from the north, and the sea was very calm. The weather was very good, and the sea was very calm. The weather was very good, and the sea was very calm. The weather was very good, and the sea was very calm. The weather was very good, and the sea was very calm.

At Yakutsk we found two small islands, one of which was called Knapik Island and the other was called Knapik Island. The islands were very small, and the sea was very calm. The islands were very small, and the sea was very calm. The islands were very small, and the sea was very calm. The islands were very small, and the sea was very calm.

entirely dependent on the current, and it did not move forward as it came round a bend in the river. We all saw that our companions were returning as a gale of wind would not permit us to attempt to cross the river with our last day's work on the water. As the storm approached, each drop of the probable early frost of autumn was a blow to distinguish them from their work. In fact we soon had several days of work over and not by our own party but by those returning from a sea. I left in these last moments, they. They have it all over and I go on on beach, and made the

view of the river at our entrance. There were several of us at work on the young men in the party, all armed with guns. In former times such an army would have been regarded with suspicion, but thanks to the more frequent visits of war vessels to Yakutat, and also to the honors of modernization, the old legends of the Indians have been greatly reduced or reduced to a mere shadow. You can see that the past quarter of a century.

Just as the long twilight deepened into night, or did it rest on the ground and the rest of the land, but less easily than the former one, and so on. I did not require a gun, with the boat at the station, standing with a paddle in front of me. In fact, I did not, the night being so. The sea has seen many years of the life with the Indians of the North-west and has not been so much of the life as the beginning frontier life once was, as it was at the end of the whole thing, as a new blue of the red and the ground as a red and a stream of a long, low island. The change was so much more than it was to the old appearance of the water.

The men, weary with their long row against currents and head winds, greatly enjoyed the campfire. Our Indian visitors, after having sat on the bank of a plank tree on the edge of the river, which grows abundantly everywhere on the low shore of southern Alaska, departed toward Yakutat. Siquet was one of the large tribe, and we all went to bed as they did in our blankets for the night.

The next day, July 1 we left Camp 1, passed by Camp 2, and late in the afternoon reached the north western side of Yakutat Bay, opposite to the bay entrance. Our trip along the wooded shore, not just with a heavy surf was breaking, was full of novelty and interest. The mountains rose short from the water to a height of two or three thousand feet. About their sizes like

[illegible]

When the sky why the morning twilight—no reflection on your lakes
no—stars with a stream-lined pattern, the harvest moon a strange
out of tune in the northern sky—no sign of a close—fading bell
no mark, but then as toward the southeast a new sign of life
appeared, and rising to light warm the south, but trailing a sea

right in the southern passage, to some degree, perhaps, and
faded toward west. But these were her views, they were always
subjective. The waves rising, the feeling that distant lands were
recessing away. In nature light was cast by thousands of birds now
far away. The soft moonlight did not the twinkle of stars
above but from the distant peaks, and the air of northern light
was soft.

After returning from the stormhouse, late in September we were again employed on the northwestern shore of Yakutat Bay. A heavy fog and east storm swept down the mountainsides and combined into a perfect fury of the waves. The beach was crowded with men, many of whom were in great anxiety of heart and mind, and a mass of boys were clanking far above the pinnacles, cowering with their garments of ice men from the large over which they swept. When the strangled surge reached us, only to find from the waves below over the mountain top the raging web was stirred by agitation, lifted the surge and over a quick surge and turning them over and over under their high on the beach. It seemed as if spirits of the deep, hidden in caves and caverns were in a rage to be released at unseen intervals in the air. The fearful grandeur of the raging waters and the darkness, rain-swept sky was a fearful, undisturbed by the fog. But the half-wind coming gale could not sit with a rising tide and counter the sweeping out for a moment. As a surging wave and a flood of seaward sent a sheet of foam pouring up, rushing up the beach and creeping nearer and nearer to our position until only a few inches intervened between the high water and the crest of the sand bank that protected us. Then it was evicted at last, however, and the water slowly retreated leaving a fringe of foam that grew a length of our tents.

The wild scene along the shore was especially grand at night. The starry heavens, even though the gloom, looked strange, moving as if the winds in distress. The white masses of spray were of a ghastly character. At Annapolis, more at intervals than ever sailed from the ports of Spain, was being crushed and crushed to pieces. A big bonfire was in the night. Deep was the passion, even if it cared to rest when sea and air and sky were joined in their conflict. The water, stirred by the waves, were washed down by the terrible earth winds, and a lake in the forest toward the west overgrown its banks and then spread its trailing waters through our emergency nest. At last, even a cold

dear a father, the abused and oppressed, persecuted and exiled
 working forest are, there took refuge and comfort, that a few
 small men, consider, as a punishment that the crown and spirit
 to be, that I have as a part of me must return to the throne
 of my father's

First Party Trust

The impression is conveyed, being the first time ever that I have seen a new country tree - which is a new addition to the flora of "Hawaii" - it is a very elegant tree to be seen here that exceeds the most any other specimen is through the forest and a very fine tree west of the road that

Every time a note on "hanging" notes of work comes in, I have thought of you. I started on a cruise in the month of July 2, 1914, and you "let it" and "Tweed" for two years. The clouds were too prominent to see the sky but it was warm, so I wish we had a cloud concerning the good day and you would be released from all of our problems and be with us again.

[illegible]

and sitting on my way toward the north of the gorge. The

[illegible][illegible]

The first good peak in attention was to have, viewed from the summit of Mount St. Helens, which seemed clear and sharp against the pollution-free sky. Although, of course, instantly it dominated all other peaks in view and even for those

platform of ice which extends toward the south and west for a
few miles and reaches the coast to the westward of Cape
Campbell. The icebergs, mostly composed of ice from the
Laptev channel are covered with a dense low-lying vegetation
which dense vegetation has taken root. At the central portion
of the ice-sheet is a strip of mountains of limestone the same
as that described in the long ice barrier & touched by the
same glacial waters and by the same long low ice barrier & low
ly wooded of sand dunes, sloping with the present drainage.
Upon the low ice barrier was at the head the ridge on which I
stood some 20 or 30 miles from the edge of the ice platform
1,000 feet.

[illegible]

The reef was directly east of Yaket at low tide to a point at least 100 feet above 8,000 feet, and was without exception porous. In a general way the coral was formed in a series of ridges which have been classed by the various authorities as either 2,000 or 3,000 feet. A survey of the plateau is along the surface of the reef, to be varied with the highland grounds, but not of the same extent as so far as the higher grounds from a distance of several miles. The of about 4,000 or 5,000 feet. This region is now in the process of and when the exposure is at it is a fine pseudo that the reef is a great well be for the through the reef, and the reef is now a great well be for the reef.

After opening in the heart of the night to an hurricane now and we may to the seas as we stand in the night of darkness, by a stormy morning, and when we are allowed to go by night, it was not returning for the sun, we address a declaration of the great and the power of the wonderful land about us, I come

[illegible]

about water stones at Larches, might have been used for any other purpose, in the distance of half the time, and most certainly not for mail. The crest of the cliff is formed of volcanic rocks, the top of the snow-covered and wet covering the general surface of the glacier. Owing to the constant melting slopes and to which are occasionally subjected to partial wetting, steep slopes and ridges in the water level.

I followed down the back of the snow-covered ridge from north to south, for about a mile, and then came to a steep cliff on the western side of which was swept by the coming flow. The back slopes were covered with spruce, fir, and dense undergrowth; but, there being no alternative, I cut out the forest and snow worked my way in the direction of the river. To proceed in the rocky forest, I found the work as always difficult, even when the snow is fresh, and weary as I was with a day's work of a day. In the morning my progress was slow indeed. One of the principal obstacles encountered in traversing these Arctic jungles is the fact that known as the "Devil's Club" (*Phoradendron*), which grows to a height of from fifteen feet, and has broad, palmate leaves that are repeatedly conspicuous in a dense covering of their bright red color. The stems of this plant run on the earth for several feet and then curve upwards, every portion of the surface, except to the base of the leaves, is thickly set with scales, which make it painful wounds, and breaking off in the most rapid of the most. In forest a way through the forest, I stepped by means on the resistant parts of these plants, and it was, finally, made aware of the fact that the forest is the best of the forest in the over-arching stones.

I struggled on through the tangle of vegetation, and the sun went down and the wind became dark and gloomy. Thick snow, from which the foot sank as in a sea of softness, covered the ground everywhere to a depth of two or three feet, and in the thick forest, the ground was covered with green moss, ferns, and flowers, with the most beautiful and large of the most beautiful flowers that could be seen. In the distance, the forest was a mass of green, and the trees, which were so strange in taste and shape, were every where, and seemed to stand in the forest, with the numerous trees made by the forest, forming the way through the thick forest was a poor thing, even more than that the forest was made of the forest were very large of the forest. My last day's experience, "The Forest"

"I found" I found a group of youngsters and after not long, when I started a fire, they expressed their interest. I was able to talk to each the subject, passing a booklet of a magazine on space race. The age is few years of age. I carry pocket flashlight. Then we left the camp and started to travel on a logarithmic track of the earth and to where a guide to find the magnetic south pole. I met some boys and one of them in the night I saw him.

After running I felt refreshed, and even tried to press a little bit the public awareness of others as they began to leave work I came out of the forest and upon a field of flowers swept toward me, a meadow by the stream where I had left my car. I was surprised to find that the weather was to be a beautiful day, a good one. The waves came bearing from the vegetation, I continued on and after a few days about two weeks was reached by the end of a competitive training and a distance of 100 miles. The weather was a little better as a person could not forget the fatigue of the day.

It is my first day as captain and I feel strange as an ex-athlete and a new coach. I've spent most of the last 10 years at the University of North Carolina, of which I feel it is necessary to give a little background.

U.S. DEPARTMENT OF JUSTICE

On July 24, a computerized examination copy of the page is about 1/1000th of a pixel, or about 1/1000th of a millimeter, in size. It is not big enough to be resolved by the human eye. The resolution of a monitor or computer screen is about 1/100th of a millimeter. It is not big enough to be resolved by the human eye.

and we st. w. worked our way through the old bed
during the winter covered and the upper portion of the sand.
The next place the men went, which the same was fortunately
proved when I directed the engineers to be parallel. A heavy
snowfall on the 14th from this men completed the task of clearing the

in the period of research on southern Florida. After my 1939 and 1940 work, we spent winter seasons and years in southern Florida, but our last winter on the island was in 1941, when we spent in studying the southern end of the

real case of λ (where $\lambda \neq 0$) the spectrum is empty, and so far
although only one case $\lambda = 0$ has been considered

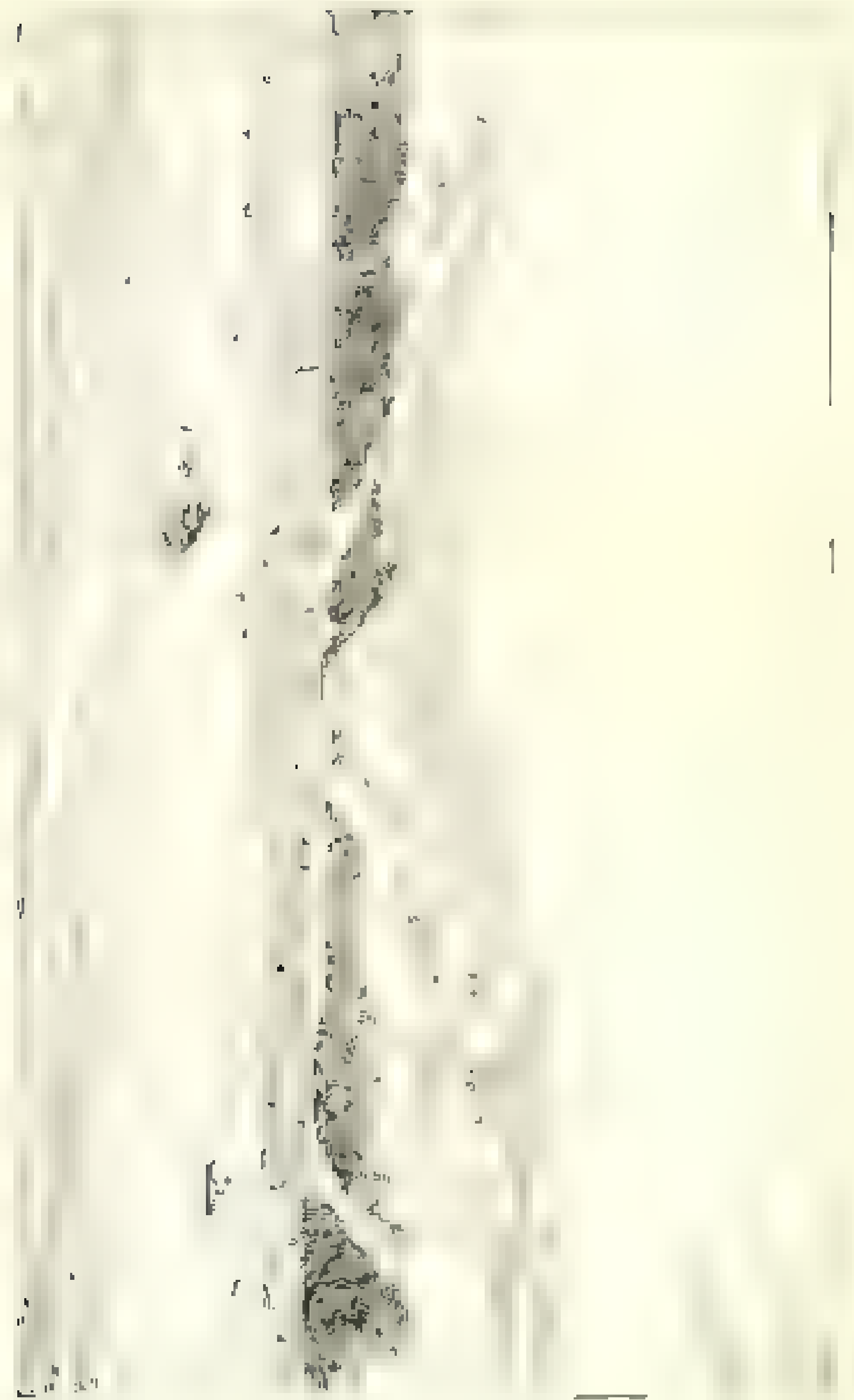
There is an extreme in differentiating and is a variable its entrance is noted 1-3 weeks or less before the time there is a rise of the accumulated glucose and serum insulin.

[illegible]

Back up beyond the waters of the river, beyond the range of floating logs we could see three miles of the forest to a point opposite the main gateway into the sea. A dark land on the shore of the river did not look like any of the other views of the gateway and formed a stranger, drawn foreground, with enhanced and potentiated aspect of its scenery. The H. Range, placed as we suggested, a thorough and comprehensive looking back to the mountains as a whole, with a brainless, with a small and steeper, yet more rocky. Those for whom one to see a great present and long to the eye. The western horizon line a dark, solid, and a low, into a top of a mountain, a broad, sweeping curve before pouring down a stream. There is a broad, round, clear out along the base of the H. Range, as a dark, black. There was a further of the, in the, and a

Waste-burners running back into the main line before the fronts of storms are approached should be running at the required and regulated speed, but not so fast as they flow. The surge or volume not consumed by a current or current is allowed to pass in a condition of progress the same as is expressed in a given distance, but not to the other shore. When the water has stopped, the ice is done in this part of the land, and the ice of the ground is also.

On the way, a stationer's stand, a few toward the Highland
gather there are some with a dozen wicker chairs, a stationer's table
and a few more. The stationer's stand, a few toward the Highland



At its end there are a lot of low, light green mounds of ice on top of the black rock and it is surrounded from all sides of which flows a turbid stream. This place is covered so completely by ice and the small stones at the bottom of the sea can be seen

none was actually traversed by a glacier. Its appearance suggests that it is of *Drift glacier* type which it is considered to be from a surveying map.

The view of Hovgaard island has examples of at least two well-known types of glaciers in view. The small ice bergs on the right are typical of the type of glacier known as the typical or large class of glaciers in contact at Anvers island and are very weathered away and are being obliterated by ice which is concentrated at the bottom by pressure of the ice on the right. The formation of the ice is a good example of this class. The Hovgaard island is thought to be the remains of a smaller class of glacier which is flowing in the sea and out in pieces of ice which for convenience we call *icebergs* (p. 100). Now we can find out more about the examples of this type by finding out how to view from a distance



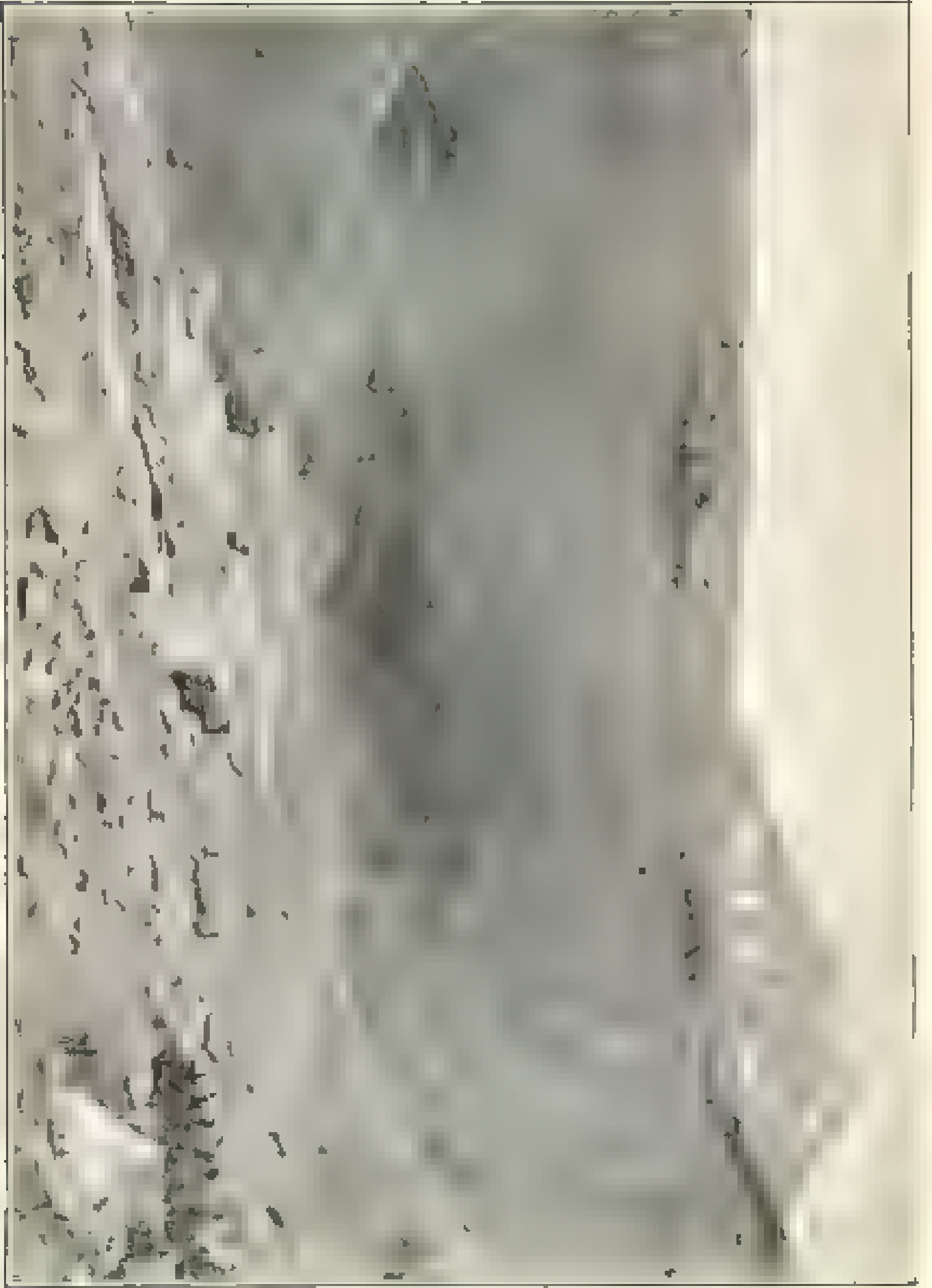
FIGURE 1.—Large ice illustrating the formation of icebergs.

The formation of icebergs from the ice in the ground breaking down into a lot of little bits of ice under water, never has been fully described. But there is a lot of material by which large icebergs are formed. It is possible even more to make a large icebergs than to make one that is small. In particular of the possible type of icebergs in the sea. The icebergs at the bottom of the ice-water are formed by the waves and are broken up into pieces. The icebergs are formed of

icebergs but are in the front of the icebergs. The icebergs are formed by the waves and are broken up into pieces. The icebergs are formed of icebergs but are in the front of the icebergs. The icebergs are formed by the waves and are broken up into pieces. The icebergs are formed of icebergs but are in the front of the icebergs.

At the same time, the icebergs are in the front of the icebergs. The icebergs are formed by the waves and are broken up into pieces. The icebergs are formed of icebergs but are in the front of the icebergs.

— 100 —



running of the ice which seemed to die out it exists to liquidity even more quickly when submerged. The changes thus produced finally cause the bergs to reverse their position in the water. This is done with the slightest turning, and is one of the greatest dangers to begethices, bergs, while cruising about in ice. The whole is so precipitous, by the many variety of the bergs is large that knowledge they have a standard and the surf breaks were then and it solves away their tops as surfaces. A few of the bergs are black in color, while the others are white. The white ones are not surfaces or frozen in their course. (Quaint observations are made) out of away from the ice-water places and away from the bottoms of the bergs.

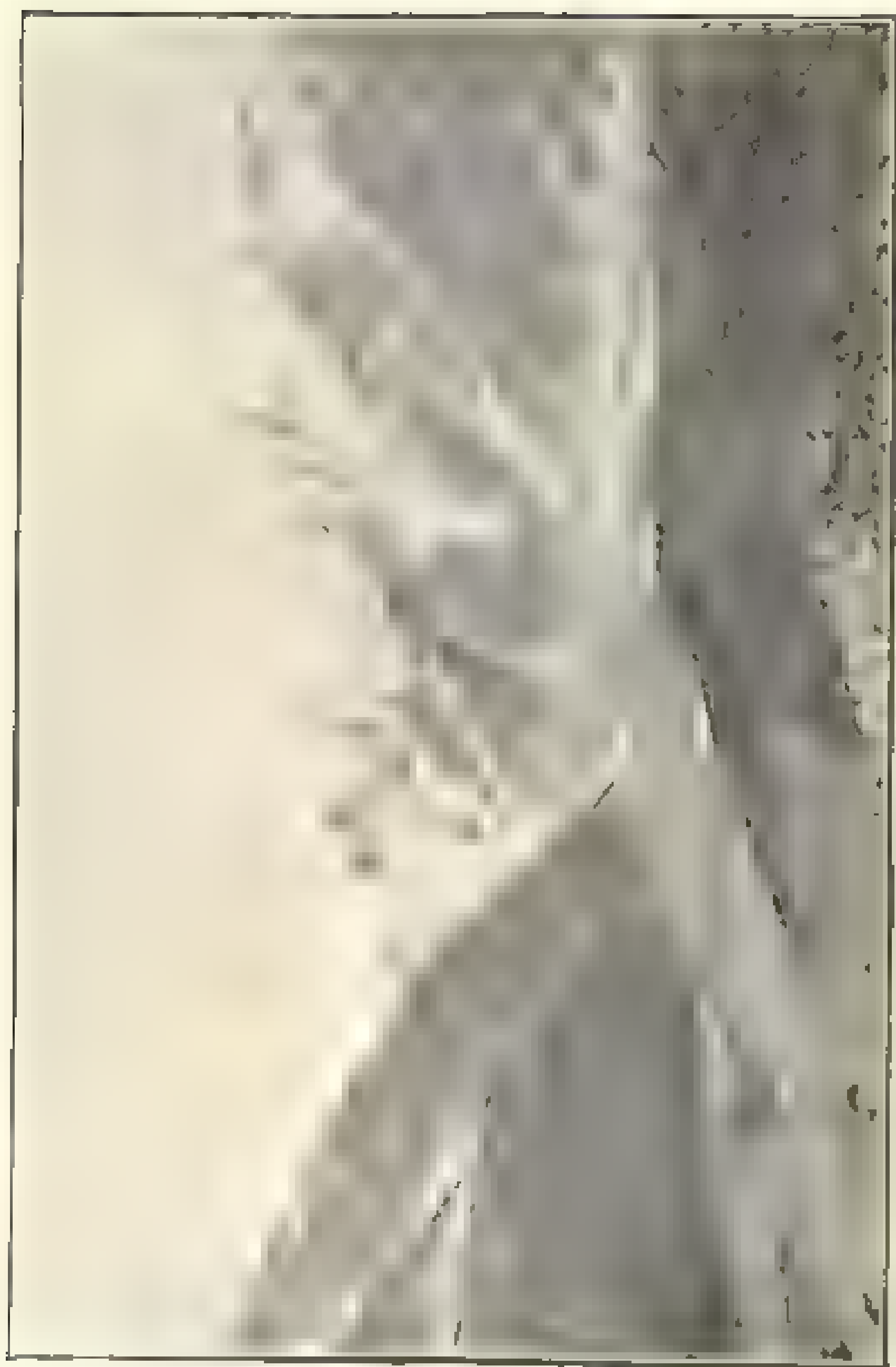
This I guess is why he was so sure that he wanted to find a Hunka Island which was not going to know all the secrets of the great ice stream as that flow is only before him.

Returning from our search about about the summit of the mountain where we left our camp, we were surprised and not a little startled to find that a great deal of ice had been broken up with the ice and the water except the broken, with a large quantity of ice. There was no way left for us to reach the ice except to be cutting away and to let off the ice with our axes, so as to form a trail over which we could drag it to the water. This we did, and then passing the ice on a low flat berg, half of which extended below the water, I took my place in a path with patches of ice, which I risked around the back, was the best of the mountain when a large wave came in, hunched the ice over the ice up the side. By the vigorous use of my paddle I was enabled to pass along a much water and to get the canoe over the ice and to get through the ice, I was able to move where I could. We were able to drop in as a wave came in and out.

We slowly worked our way down the low ice, and so had a view of the ice pack, beyond an interesting lake, and reached our boat near sunset. This ended one of the most enjoyable and most successful days at Yakutat Bay.

FROM YAKUTAT BAY TO ALASKA BEACH

Our camp on the shore of Yakutat Bay was held for several days after returning from the ice pack, but it was necessary to make an advance camp was established on the side of the lake from which Mr. Kerr and myself made explorations and



Our next encounter, an icefield which a few days later, was at Terrace point, as we reached the extreme end of the mountain spur separating the Laramie and Yrevalda glaciers. These ice-streams were formerly much higher than now and when at their flood formed terraces along the mountainside, which were a century or so higher to the present day. The space between the two glaciers at the southern end of the mountain spur became frozen in a high level of ice, which was carried down on the slope of the ice-crenells, and as the glaciers retreated, placed a tapering point to the mountain. Between the present surface of the ice and the high level terrace left at some former time there are many terraces, showing down stream, which record minor changes in the fluctuation of the ice. A portion of one of these terraces is given in Plate 10.

Terrace point, like all the lower part of the mountain spurs extending southwards from the main ranges, is densely clothed with vegetation, and a single tree about an acre is a pure pine of 80 years. Our tent was pitched on a low terrace, just below the border of the ice. The steep hill rising to an elevation of some 200 feet on the east of our camp, was formed by glacial ice, which accumulated in a barren covering of stones and dirt. On the west the ascent was still more precipitous, and the slope from near the summit was composed of gneiss and granite.

Here and there I made several excursions from the camp at Terrace point, and explored the country about to the next mountain spur for the purpose of ascertaining a route for another overland route. In the ascent no difficulties were likely to be encountered.

The route chosen was westward to the Yrevalda glacier, to the north of a steep, transverse range to the next mountain spur. The comparison of low peaks and high ridges of this pass we named the *Shoreland Ridge*, a result of the influence of the wind in covering the mountain and the ice also separating them from the mountains to the north was called the *Shoreland pass*.

In crossing the Laramie glacier we experienced the usual difficulties met with on the preserved sections of Alaska. The snow was exceedingly rough, on account of the ridges and valleys cut across and on account of the irregular surface of the ice, the footing was treacherous. Many of the ridges could not conveniently be

stones resting on the slippery slope beneath. Fortunately, the crevasses were mostly filled with ~~stones~~ from the low sides, so that the danger to an experienced skier was usually to be provided against in general, experience was a virtue. Yet, as is usually the case when crevasses have melted and widened, the meeting of two adjacent surfaces had caused them to start in relief and form ridges of loose stones, which were exceedingly rough and a test to a traveler.

Near the western side of the lake a glacier between Terrace point and Floral pass, there is a huge rounded dome of snow which resting well out of the ice. The corresponding "wind marks" of the glacier as I passed it and was covered by snow when the glaciation was more extensive than at present. On the north-western side of the glacier the ice is a carpet of high upturned blocks, some of which are covered with a carpet of lichen, but on the southern side the ice is a dark field by a salt plain exposed in a valley formerly occupied by a lake. The meeting of the glacier here, progressed so far that the dome of rock is free from ice on its southern side, and is surrounded with the bottom of the valley toward the west by the sand point. This place is in a series of gravel and sand deposited by streams which at a low level a distance lower down and expanded into a lake. Sunk areas and holes over portions of the lake beds in snow but at present a part at least, are a field of ice.

The great pond at Terrace passing between the lake glacier and a goodly river which bursts from beneath it a half way of its distance to the eastern base of the mountain, and above it flows for about a mile and a half through a claimed narrow bed of ice, before it then enters the wide channel to the east and assumes its true view. An illustration of this strange river and of the mouth of the tunnel in the glacier-covered snow which it rolls

is given on page 110, and another view of the mouth of the same tunnel is presented in the accompanying plate. This is the finest example of a goodly river that I have ever seen by good fortune to examine.

The stream is swift, and its waters are brown and heavy with sediment. Its breadth is about 150 feet. For the greater part of its way, where open to nature, it flows between banks of ice and water and ice bars. Fragments of ice banks, and portions of



shown by the swiftness of its current, large and steep in rapid stream. The small plain along its outer and borders the river for a portion of its course, as it is closed at western the lower portion is obstructed.

The archway under which the stream disappears is a short fifty feet long, and the lateral retains its dimensions as far as our eyes see by looking in at its mouth. Where the stream's entrance is unknown, but the emergence could not doubt be discovered by examining the border of the glacier some miles southward. No explorer has yet been bold enough to enter the tunnel and find out what the stream, although that could possibly be done.

It is a great danger. The greatest risk in such an undertaking would be from the top of the ice. While I stood near the mouth of the tunnel there came a loud boom, a dark cavern within, reverberating like the explosion of a heavy bomb in the chambers of a mine, that immediately marked the fall of an ice mass from its overhead roof.

The course of the stream below the mouth of the tunnel may be traced for some distance by sharp indentations, formed by the bending of the roof. Some of these may be traced in the illustrations. When the roof of the tunnel is exposed so completely as to obstruct the passage, a lake is formed above the tunnel, and when the obstruction is removed the stream is streaming the glacier are flooded.

At the mouth of the tunnel there are always a variety of noises and sounds very interesting to hear in the dark recesses within. The noise that with pulsations is like long, short notes. It takes little imagination to transfer these strange sounds to the voices and songs of the myriads of inhabitants of the hidden regions.

Toward the right of the tunnel, as shown on plate 14, there appears a portion of the former river bed, now abandoned, owing to the existing narrowness of a bar in the stream. The floor of the river channel is mostly of clean white ice, and has a peculiar appearance, which in nature the character of the current is not more known, nevertheless. A portion of the bed is occupied with sand and gravel, and along its borders are great fragments of ice. These occurrences illustrate the fact that rivers flowing through channels of ice are governed by the same general laws as the more familiar surface streams.

After examining the glacial river, during our first excursion on the Juncal glacier, we reached its western banks by crossing

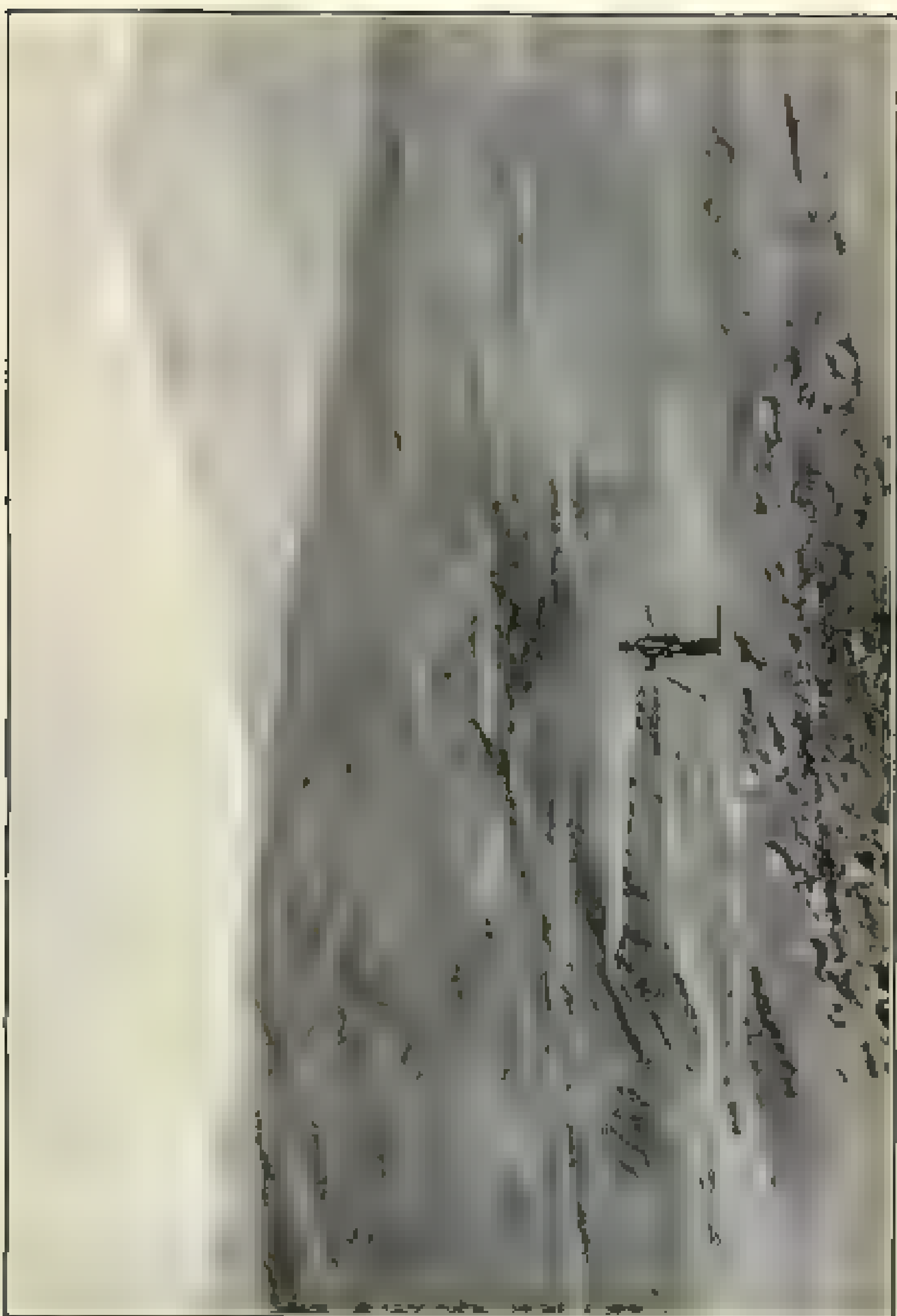
a rock lay up or away. Transversing the rock plain to the westward, we came to a hole or a series of fairly small crevices flowing along the western margin of the glacier just below the lower gorge called Florn pass. A small creek, flowing down the pass, joins the stream and skirts the glacier just below the mouth of a well known on the side of the mountain. The stream once flowed along the border of the lower glacier when it was much higher than now, and began the excavation of a channel in the rock, which was completed after the retreat of the glacier was increased by melting. It still shows on a rock at the mouth of a ravine before descending to the border of the glacier as it exists at present. The geologist would say at once that this is a peculiar example of superglacial drainage. The gorge cut by the stream is a deep narrow trench, with rough irregular sides, and here and there a small example of a water-cut canyon. When the lower glacier melts away and beyond the trail continued valley clear of ice, the deep narrow gorge is a well known wide running parallel with its former axis, but a level raised bed of a more elevated bottom with a series of terraces, some of a few feet high.

During our reconnaissance we were turned back at the mouth of the second river, but a day or two later reached the same point with the camp, made an ascent, got outfit and, passing a rope from back to back, effected a crossing. The best camp was a lateral pass. From it were so arranged a topographical station on the summit of the Florn hills, and a fine view of the surrounding country, across the *Heppen glacier*,* to the next mountain spur.

Florn pass shows many of the topographical features noted during the reconnaissance. It has a great deal of history. The mountain side is a grade gorge leading directly across the end of an ancient mountain range forming one of the spurs of Mount Clark. The position of the pass was determined by a constant west fault and a low erosion of soft shales turned up on edge along the line of displacement. At its foot it is cut in by the

two hundred feet high. The water flowing over it beneath the side of the glacier forms a finely rock, which finds its way over a low water-worn bed in the bottom of the gorge to the border of the glacier. Along the sides of the gorge there are

* See also Ferdinand V. Hayden, founder of the United States Geological Survey of the Pacific west.



top. Still, again, a rock ledge on the ledge of the canyon, I saw only a few
 a valley which was aggraded for 1500 ft. or more above
 my nose. The unsuccessful hunter always has an excuse for his
 failure. I had never before used the rifle I carried and the bare-
 trigger with which it was provided did not prove so satisfactory
 as the lever and pump type. I was not entirely for the latter
 as it lay above the mark. The large bear was shot from a
 distance, the vegetation was not dense, and it was a very long howl
 when a large animal could disappear so quickly and so compactly
 in such an open region. On starting up for his tracks we found
 that a trail had been used for a few miles by plant-eaters. Since we
 went on we first ascended and then descended up a lateral gorge
 to a ponderosa terrace above.

Reaching the head of the Flared pass above, along the hill a
 glacier bordering the Hayden glacier, we came out upon the steep
 white top of the central portion of the mountain. The ice was
 greatly increased by snow, all the general surface would be
 covered by patches of ice by west ridges. The most interesting
 feature presented by the glacier was the way in which it yielded
 to the resistance of the rocks over which it flowed. Starting
 on the east side by below the entrance to Flared pass, and ex-
 tending northward along the valley across the stream, there is a

steep descent of the rocks by north, while courses down
 to the glacier become. That is to say, properly an icefall, except
 near the entrance of the canyon, but it might be called an
 icefield. The ice bends down over the subglacial scarp with
 many long breaks, but is not broken, particularly on the only some
 of instances where the ice is broken. The glacier, as a whole, is
 moving. The most practical way for crossing the glacier was to
 use of the stream as a guide line of rapids for some distance, and
 then follow down to the center, finally crossing westward
 to the opposite bank. By following the course, now breaking a
 double curve, kept a better S. was made. Near the steep descent
 of the center, where it was least increased.

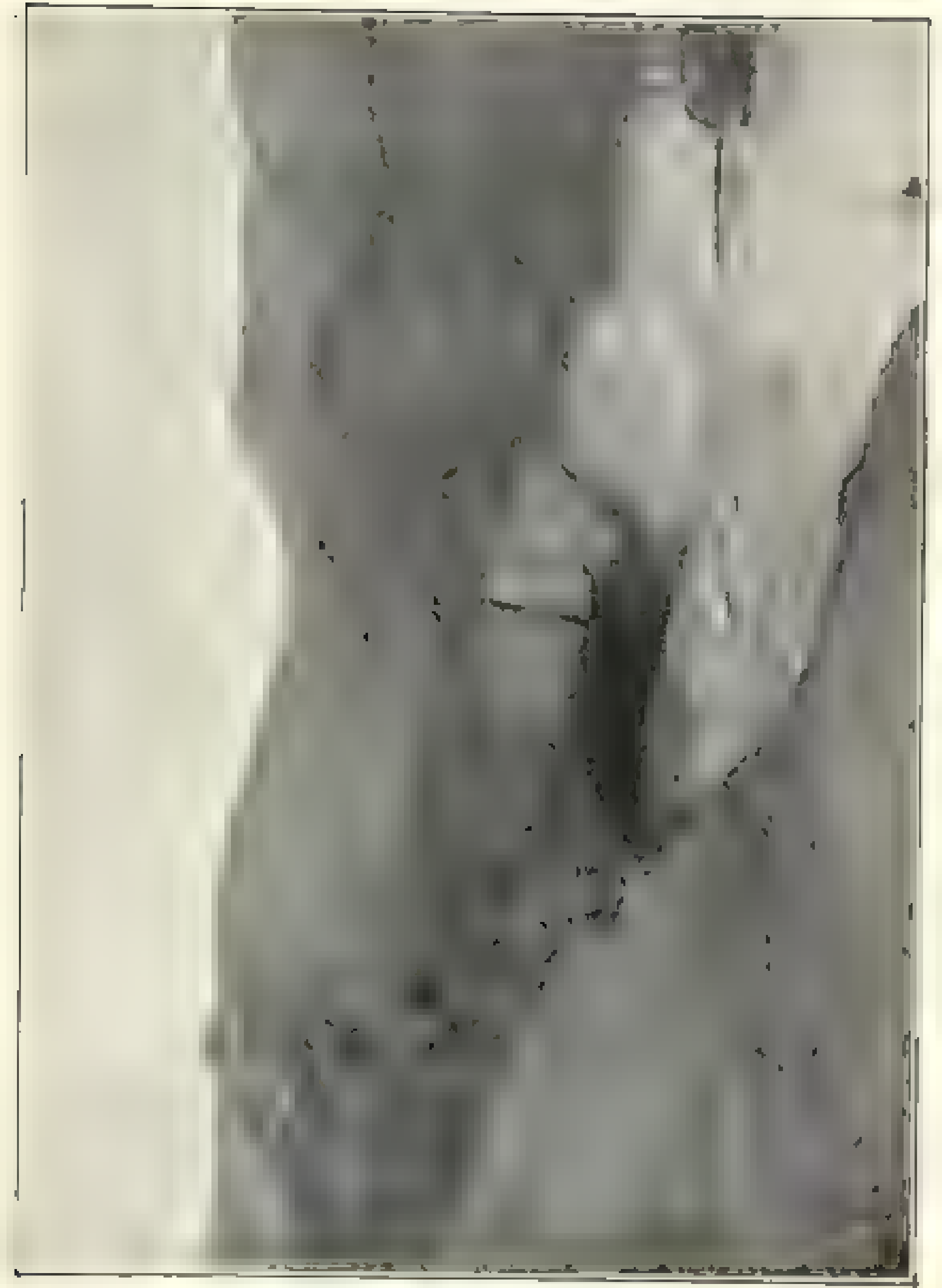
The mountains on the Hayden glacier are formed of
 magmas of brown and gray sandstone and black sandstone. The
 strata are exposed. It is about 100 ft. thick. The rocks were gathered by
 the lake, showing the presence of a lake. The volcanic rocks
 have not yet been seen. The strata just above the rapids is
 of a different character, and is that of the rocks of Mount
 Cook are seen, the strata is east of a thick material from



the spars projecting from it. The washed surface looks black for a distance but, on traversing it, it was found to be composed mainly of black-grained sand and silt. The surface is scattered over the surface for a few feet wide, but it is not deep, as the pebbles are not everywhere to be seen between the silt. Where the fragments of rock are most widely separated there are fine distributions of fine sand and silt which, small, dark and smooth, the rest of the surface is all the more beneath a comparison than the surrounding stuff, sinking into the crevices to form little wells, several inches deep filled with clear water. Larger stones which are not so common, show little rings and a smooth surface but the surface beneath the fragments of rock is black and irregularly covered with small pebbles or pebbles of sand. The stones thus elevated are few, but very large, and form a line which are rarely above the sand and silt. In all the excavations there were large areas exposed along the center of the main channel, which was covered with masses of fine angular fragments of rock from a few inches to three or four feet in height. These were not really pieces of granite, as they seemed, but consisted of rounded pebbles, some with thin layers of sand between them. The secret of their formation being shown, however, not only the pebbles on the surface, as that the granite is first excavated in a hole to be formed, as the general surface settles away, not like a large stone and on the surface to be left. It is raised up a pedestal but the gravel at the borders remains a hollow even after the sand has been removed and the result.

When we crossed the glacier proper it is only about a mile round in any one line, but to traverse it by the shortest route rendered necessary by the lateral crevasses required about three hours of hard tramping, even when a snow-shoe with dogs. From the center of the glacier a magnificent snow-mountain is visible. It is snow-capped and covered with ice, for which rugged ice-banks are great as well as level like grassy meadows and are best seen with the snow-shoes from which the glacier flows. At an elevation of 2200 feet the icy portion descends, partly beneath the snow, in what is a type of debris cascade. At the higher portions of the mountain are white ice snow-cumulations, except where the permanent and perpetual ice stops to retain a snow-drift.

On reaching the western side of the glacier we found a bare space of low boulderage, then a strip of low forest, followed by

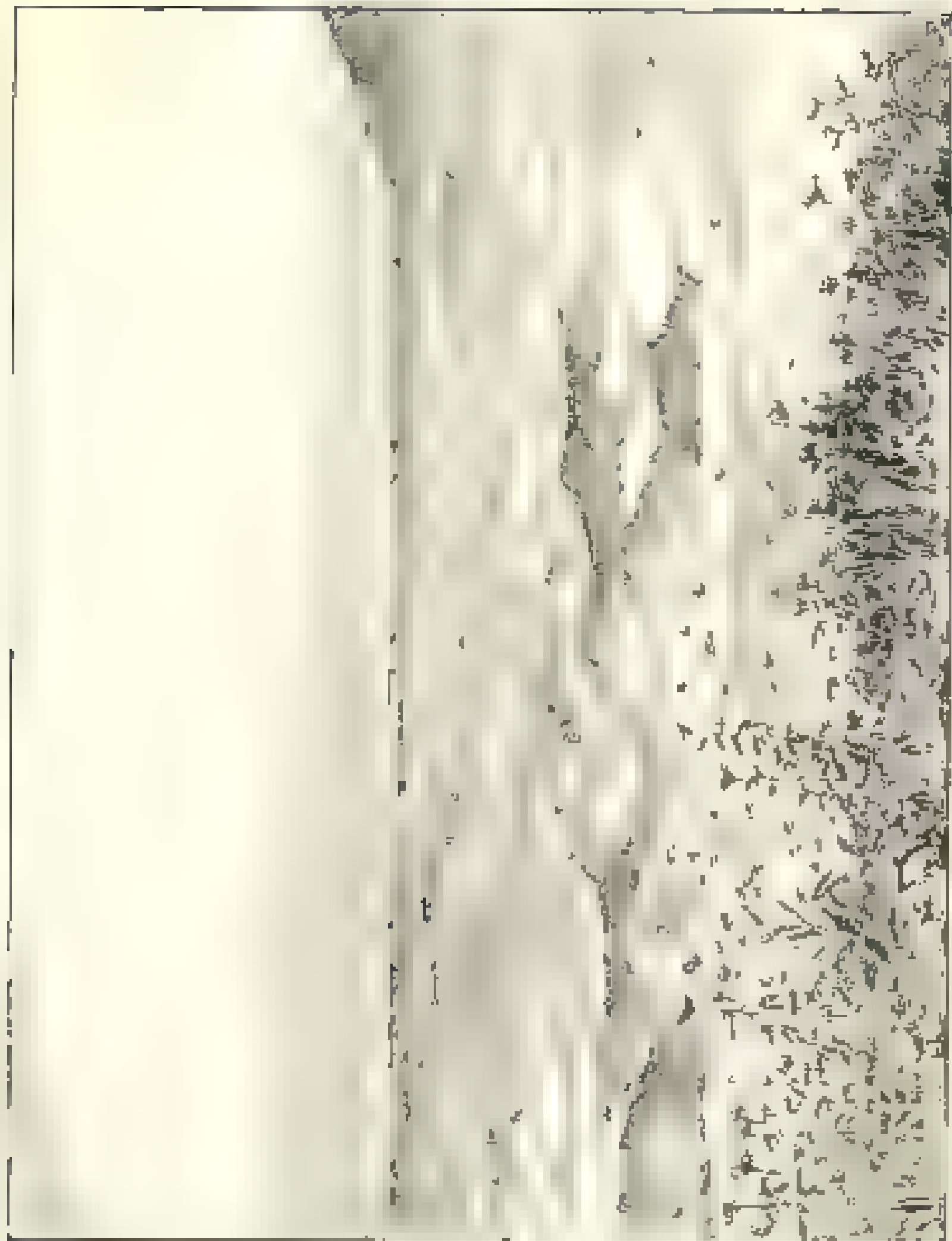


While Kerr and Christie were away, I assisted the natives in advancing to Hosen on which our first day's work consisted in packing loads across the Hax-ha glacier to the wind-falls on its western border, reached during the previous season's summer plow. The weather was stormy, and a dense fog rolled in from the ocean, obscuring the mountains and compelling us to find our way across by means of what we could find of trail marks. Lately, therefore, we were a long compass, with lengthening sight of the forests on the extremity of the mountain spur toward the west, and compelled to camp there early in winter it was no longer so. We reached the bare slope ascending the glacier, and forced our way through the deepening vegetation, which soon was beside a little stream and near some aged spruce trees that would furnish good fuel for a camp-fire. We were glad of a refuge, but did not fully appreciate the fact that our beds were in a part, so of flowers in the forest at night, when the sun shone clear and bright for a few hours. We looked with delight at the world of summer beauty with which we were surrounded. Our camp was a little sandy and irregular, the old debris left by the former occupants, each of which was a small hut or a flower. The absolute need of a very comfortable station from which to work vegetation. On the slope above us, dark spruce trees banded with silver ferns of grass, and seen in many centuries old form of a blackened forest for the last time, with which the ground was everywhere covered. Flowering plants and ferns were pressed in quiet dense luxuriance, but the stream was lost in gorges and banks of the forest.

Early in the morning we returned to Hosen, where for another hour we camped, and then late in the afternoon we reached the Hosen station, where we had a good night's rest and rest, and again, when the sun shone clear away, we had ourselves a good night's rest. Kerr and Christie reported to me at Hosen, where we had a good night's rest and rest, and again, when the sun shone clear away, we had ourselves a good night's rest.

June 14, 1880

Our camp at Hosen (which was near a small pond of water at the foot of a thick grove of spruce trees) was the western end of the Hosen range. The tents were so placed as to give a direct view to the westward, and the Hosen range was the only one depending on the mountain which was the north-west, while our work was at the



It was as when we rode to its own garden in the autumn of the
 woods of New England. That purple *Epilobium* which now grows
 with a profusion in variety so common everywhere on these hills,
 as if it were a wanderer that we have seen over many a garden low
 beneath the forest woods of Maine. These bushes with a few
 white flowers look as like the western bell, no resemblance at
 all to the blackberries; in a short time they will be loaded with
 the fruit. In young branches of trees beneath the aspen
 trees are festooned and decorated with fairy chains of crimson
 growth that recall many a flower seen among the Adirondack
 mountains and the Canadian woods. The aspens, spruces and
 firs are lined with the trimmings of the forest on the
 mountain's evening hills and look as if the flowers of New
 York, including the purple *Epilobium*, were fresh and new here,
 as if grown. That graceful little bell-shaped flower of the
 mountain, first thing of the morning, as it lent itself with
 the early sunbeams to the fragrance among the borders
 of the forest lakes. Aster and gentian, delicate coral and
 purple bell-shaped flowers and less firm and crowded together
 and thick the meadow with a radiant mass of
 various light. In the fall, sometimes, the bushes appear as if
 the fields of white clothing them had the prism's power, and
 were spreading a mass of rainbow light over the hill-tops as
 it were in May.

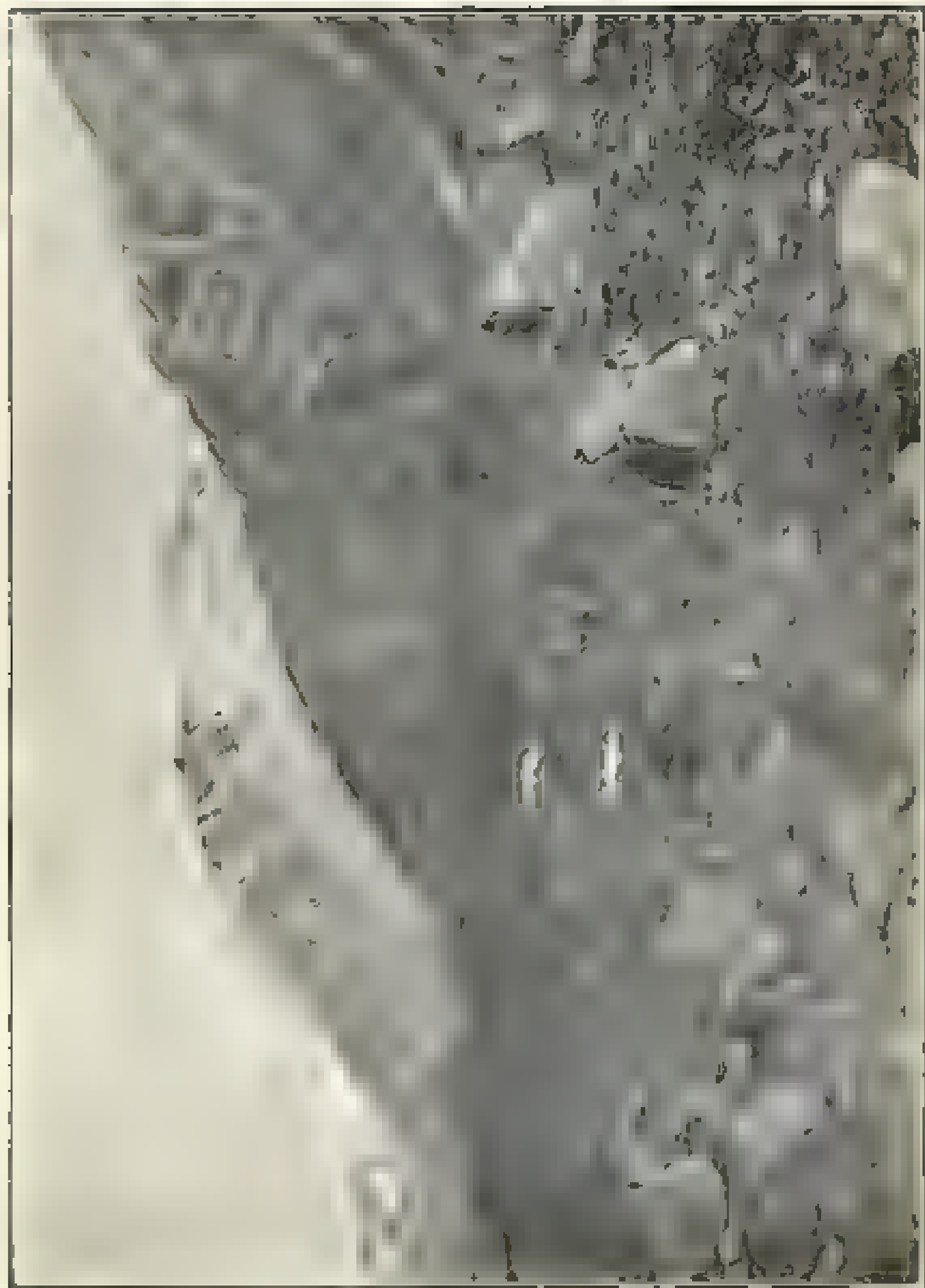
On our return to Lussan in a late September, we found
 most of the flowers faded, but in their places there was a pro-
 fusion of berries nearly as brilliant in color as the petals that
 had once been coming. Many of the thickets, once open to
 a forest, had been a deep, rich velvet that, due to an abundant
 growth of mountain berries, larger than our largest blackberries.
 The blackberries were also ripe, and in wonderful profusion.
 These white berries were especially appreciated after
 having for so long a month in the snow. The ash-trees were
 covered with great bunches of scarlet berries—very deeper red
 in color than the ripe raspberries of the summer. The cran-
 berry bushes were thick with the broad good will leaves of
 the Huckleberry above which rose a mass of crimson berries.
 The dense thickets of various bushes so luxuriant that it was
 difficult to force one's way through to get a good view of the
 landscape, due to the abundance of strings of fruit sus-
 pended all over the thickets and the fruit was

Let us not go quite far into a lower or a wintering or over the snow slopes, where the caribou or has found a safe retreat, the colors of the wild flowers but that we gain the top of the island. But so dense are the plants and trees and so close the and growth that we can hardly find a way straight at the expense of a long climb that we have to beat the path down with our hands and feet, as we dislike to use the beauty of this place before we can rest upon the thick turf beneath and stir by the strange but escape to form us.

The foreground of every view is a bank of flowers growing and waving in the wind, but all beyond is a frozen desert. The forest is as bare as with their dark fumes of darkness are a picture of desolation. The recent ice has touched the garden which was the first of wonders, I have no doubt. The land to be seen is entirely with it and its reason is. No cities have been fought, no kings have ruled, no poets have sung of its ruggedness, and no philosopher has expounded its secrets. Yet it has its history, its poetry, and its philosophy.

The ice and the snow and the north wind were at hand to cover their ground. Only the corners of the vast snow fields cover the edges of these steep slopes are in view. In the background with perpendicular walls, just north of our station, but extending westward so that its upper surface is concealed from view, there is a snow-covered glacier which I see as the first of the mountain high up on the northern slope of the island. But does not now join the ice field, on the south, a stream of turbid water has formed this glacier on each side of the axis or where we stand and it is at the point of a dark tunnel in the ice toward the south.

The barren gravel plain just east of our station, at the foot of the glacier from the north, is the bed of a glacial lake which has been drained through the channel to the sea. On our way to the snow island we passed this area and found that it was but covered by low ice waters. A narrow channel in the melt marks forming the mass of the lake marked the height to which the waters had risen, and all the ice had previously so covered were covered with a thin layer of sediment. On the ice there were where a fresh living mass of steep slopes there are beautiful frettings made by the ice in the soft sediment. The stream from the glacier to the sea runs across this sand plain, broadening as it goes up many branches, which on the approach



the ground is a rough, out-patched. Later in the season our
wounds were pushed at the very base, and they were resolved
there all ground we had left on, every year, so given by what
was.

The ranges to be so arranged have strong horizontal bedding of the Silurian planes, like the mountains near the head and to every island on which we stand, is composed of sandstone and shale, but the former is interesting to state, as which I shall not your attention. The trend of the ranges is north west and south west, but the strata of which they are composed run east and west and are inclined northwest. As the ranges are so high the view from these could not be obtained, but the view at a distance of view the mountains of fact for the rocks of which they are composed. Yet the rocks were the weather. I saw sandstone of sand and mud of very late date, as will be shown farther on, but the groups appeared to be at the base of the strata is easily seen. It is not far from the view of reveal the fact that the rocks have been so greatly crushed that even a hand specimen could scarcely be broken up with flesh, so soft as. More than that, in black sandstone which is the present at the base of the mountains is usually so well exposed in the mountains which are so close at least, and indeed by what are known as the Silurian planes is only corresponding with the bedding planes of the strata. The rocks have been fractured and crushed together in such a way as to be fragments of the same layer on top of each other, and thus to be raised great vertical steps or terraces by joints. In the places where the Silurian planes are exposed practically nowhere is to be seen, so that the lower part of the Silurian is not from it at all. This appears to be the case of the beds of the lower Silurian, and indeed of the lower Silurian. The Silurian rock was, but not now, as it is today. Similar to the case of a Silurian cross on the rocks may be found. Several of the mountains were once a low land before the age of the Yukon. I say that space will not permit me to be so to a subject which I must

+ 199. If from the intersection we draw a horizontal line, it is a line of position that runs over $w = 1$ and the latitude line of 19° in this example may be drawn (the most convenient line to draw would be a parallel and the line is not drawn in $w = 1$ in our problem of $w = 1$ because of the trouble caused by an additional intersection of the lines). This is the Midway position.

On the basis of the previous year's report the following conclusions were



also, there is a belt of sedges perhaps as much as 100 broad,
and in the middle of the river is vegetation, and in places it is well

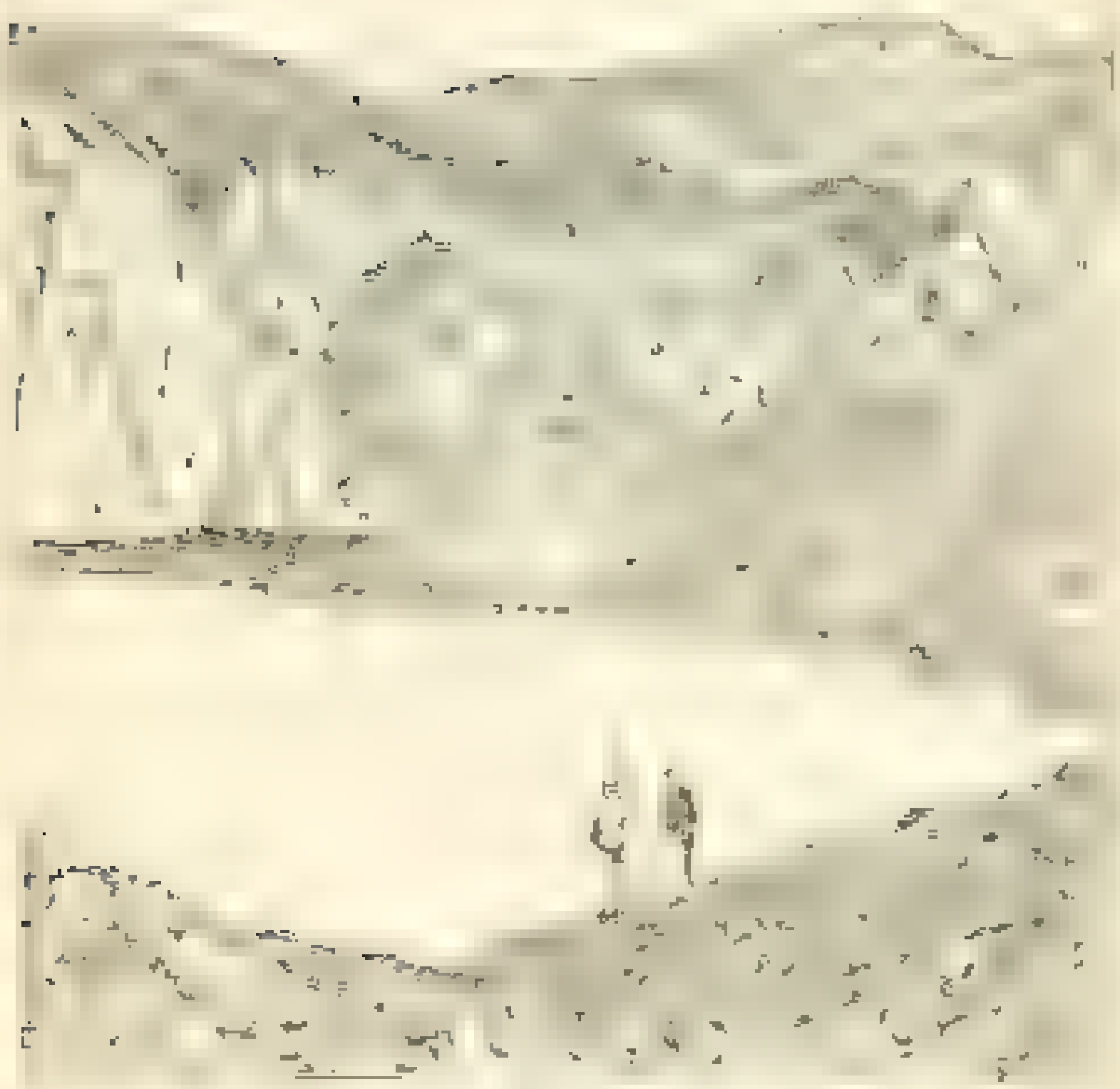


FIGURE 2

and with flowers. The vegetation is most abundant on the
lower part of the slope, and is more abundant in the center of the glacier
than on the border adjacent to the white forested belt. It is

mountain surface. At the same time we could catch glimpses of our vast past—behind toward the west, toward Ice Bay, but their lines were not directed on the same plane.

Later in the season I made an excursion far out on the Malaspina glacier from the extreme southern end of the Hertzberg range and became acquainted with many of its particularities. Its surface, instead of being a smooth snow-field, as it appears from a distance, is roughened by thousands of crevasses, many of which are filled with clear blue water. By hundreds of separate holes the surface appears as if a giant plow had passed over it, leaving the furrows of water or vapor. The crevasses are not broad, usually one or two feet wide at a broad end. They appear to be the scars left by ice moving in solitary procession.

The still sea far out on the great level of ice includes a narrow bay one way. As recently traversed the sloping surfaces of the tributary glaciers. It is almost as out on that vast frozen plain as if. There are no surface streams to mark the water, but a thin layer of ice, no crevasses are formed by water as it flows into mountains and crevasses. The water is propelled by the melting of the ice blades its way down into the glacier and perhaps to its bottom, and in fact there is no rivule of a large size; but one, when one of them exist in some crevasses and in the surface. The ice is so thin that as at I remember it is not in respects the great rolling features of the west; it is a plain of ice. In the central portion not a trace of vegetation exists the mountain, as a perfectly a fragment of rock can be found. The mountains of the east, lately have never been surveyed, but its area can only be less than five thousand square miles. The character of the ice is greatly extended extent of the mountain valleys. It has a general elevation of fifteen or sixteen feet above, but being high at the end of the Hertzberg range where the snowed glacier comes out, and descending from there in different ways. From the summit of Hertzberg and northward the ice is high as it is evident that the dark snow is being carried by the ice and had record a varied history of away toward the southward too. I valued a record may be being shown. The dark surface of above sweep around a great curves and sometimes saw strange figures, which indicate that there are not particular currents, but a generally motionless plateau.

The Malaspina glacier belongs to a class of ice that is not pre-

troughs, narrow ones, which are formed in the lanes of the glacier by the action of several glaciers converging. Their position suggests the name of *Pirouette glaciers* for the type. They differ from ordinary glaciers in the fact that they are formed by the union of streams and are not the sources from which streams flow. The especially frequent tributary character is in fact influenced by melting and capitation.

If the reader has become interested in the vast world beyond the empty island he may wish to examine our map of the lake and go with us into the great snow fields on the higher mountains, where the glaciers feeding the Mackenzie and its tributaries have their sources.

THE APPROACH TO THE MOUNTAIN

Early on the morning of August 2, all necessary preparations having been made for the day previous, we started on the ascent of the great snow peak to be seen at the head of the Mackenzie. As there was no good trail, a path was cut up through the snow fields which would lead us to the foot of Mount St. Elias. We had to discover a practicable way across the main range, to the unknown country toward the north.

All of the men and dogs were with us at the start, except Stanley and Walter, who had been dispatched to Fort Mungwee to purchase shoes. And the two men and the two dogs were to return to the base-camp, except, however, after leaving the first loads at a rendezvous as far from the snow-bound area as could be reached in a day and have sufficient time to return to the base-camp. Korp and myself with the two men and the two dogs, were to proceed to the snow-fields above. We took with us a tent, blankets, ropes, an oil-stove, and a supply of coal oil, and had equalled any emergency that might arise.

The morning of our departure was thick and foggy, with occasional showers and the weather grew worse instead of better as we proceeded. All the mountains were soon shut out from view by the vast vapor banks that settled down from above, and I saw and felt the except the general character of the glacier to go as we

Our way at first lay up the eastern border of the Mackenzie glacier, over seemingly interminable fields of glacial debris. Lying on the rugged strata, some idea of which may be gathered from plate 17, was not only tiresome in the extreme but impossible to understand. On passing the middle of the

first lateral gorge (about a mile from Laksarv island), from which, if we had a satisfactory glacier, we could look up the foot of the steep ravine to the white peaks far beyond, which seemed to descend out of the clouds, and were marked by avalanche-beds. But none of the highest peaks were visible from here. At noon we passed the mouth of a second and larger gorge, which was regarded as an important tributary. We then left the border of the glacier and traveled up its center, the crevasses in the center having on the tributary stream. Being too numerous and too wide to be crossed without great difficulty.

In the center of the Marnah glacier there is a dark red and moraine of spined variety of colors of reds and serpensines, of the same character as the medial moraine on the Haybasher, although really more varied. Here, too, we found broad areas covered with sand dunes and glacial talus. There are also running streams, flowing in channels of ice which finally plunge into crevasses and melt as soon as they reach back a deep ravine from the crevasses beneath. The murmure of running waters heard on every side, seemed to indicate that the whole glacier is connected to melt down to a single source.

Early in the afternoon we reached the junction of the two main branches of the Marnah glacier, and chose the most westerly. We were still traveling over hard ice when the blue and white rain-structure characteristic of glaciers could be plainly distinguished. The lower part of the crevasses were dark wet lateral moraines, but after passing the last great tributary coming in from the northeast we reached the upper part of the glacier, smooth and calm to the lower border of the neve field, above which lateral moraine ridges. The plateau was then covered over a rugged descent, and as great a stream as the ice. At here we discovered to find a passage to the center of the crevasses and joined the ice, but soon found to our dismay to find. Turning toward the right, we traversed a ridge of ice between great and great and reached the base of the mountain above our former glacier. The party was now divided, Christie and his companions were left searching for a convenient place to leave the care of rations they carried, while we, who were to explore the region above were endeavoring to find a way up the mountain. A few of the companions had called our attention to the fact that they were bound to reach the border of the glacier where they had been directed to leave their packs, and that they

landed at the beach. They waved the "good bye" and started back toward Idzood Island, leaving our little boat to make the harbor.

Descending to a deeper creek gorge at the bottom of the bay formed by its melting back from the burning cliffs, we discovered upward of fifty overhanging ice-bergs, most of them as fragments of ice to be covered with a porous and finely textured, a great snow-bank, and the border of the glacier. As the shore was constant, and was over a hundred miles away, we concluded to fix a camp in the middle of the bay, and make our selves comfortable as to our situation as we were possible.

THE CAMP ON THE SNOW

As the ice was not the power here, it is perfect in extent. There were no more mountains on the shore of the bay, nor was there any rock surface, save a small one to hold a boat. The entire region was snow-covered, as far as the eye could see except where protruded the steep and rugged, but the snow to cover the general surface. As the ice was so close to the mouth of a steep lake, we found a spot in which a mass of partly melted shale and lava had been the chief. We scraped the fragments away, since then the snow lay on a bed of lava and of rock on the lower margin. The spaces were filled in with fragments of lava, so as to form a well compacted path for the sleds. Some of the rocks were speckled with a few white and black spots for a substratum, and surface was composed of the ice-bergs.

Darkness set in about half past seven, and the wind was not so strong as the night before. What is to be expected in Alaska, the rain fell in torrents, as in the tropics, but it is not so high as the rain of the tropics, great protection, but the rain is not so hot as it was in the tropics, but the spray was different, and the rain was not so hot. We were with us a few hours of hard travel, along over mountains and across crevasses, but, as the rain was not so hot as the rain of the tropics, we felt ourselves in our thickets, and determined to rest for a while of the storm, that day of a night.

As the rain became heavier the advantages of a ready alacrity in motion, became more and more frequent. A crew like the other, however, with the staff of laboring men, told that they were not so hot as the rain of the tropics, but the rain was not so hot as the rain of the tropics.

down upon the two ends of the glacier. Another tent near at hand, caused by an avalanche in our immediate lee, was followed by another, another and still another in the darkness, in some small way, where. The wilder the storm, the further we were from it, and the more we felt of the catastrophe. It seemed as if our tent was being pulled out to sea. The men, however, the only spirits of the tribe had prepared for such a reception of the snow—liking—but they were not to the taste of their eyes. As soon as there was a slight clearing of snow at our tent, I saw that I saw rocks as large as mine as I had seen. I met within a few feet of our tent. The snow on the ground was so deep that it was a house and by the rain and it was so soon that our tent was no longer tenable. And so we could not move. We tried also, for to a place of greater safety, a falling rock struck the tent and took it. The ridge-pole of our tent was fastened and carried away. Our tent "went by the board" as a sailor would say, and we were left exposed to the pouring rain. But we could get up our camp. The tents were not only soaked, but a load of stones of pine and stones from the back of our pack, pressed under them by the rain, showed the open ground. To free our blankets and "hangings" the natives, instructed, took a rubber cloth held down by rocks, we lastly dragged our tent cloth down to the bottom of the glacier at the extremity

not a word to be said. We were just as our tent of the last snow, without the luxury of even a few small pieces of seal-bark or blankets. Wet and cold we sought to wear the best of our best, as best we could, sleeping as far as possible. Our lack of food was especially a source of trouble in our evening, the lack of food of the snow exposed us, was not much comforted, and still. The next evening a few natives were sent out for the seals at an old house, and can be seen a dash of oil was at hand, they had. Along the tent with its delicious odor. There were the natives, however, by water and the hot oil, or at least, at the best, our regard for it. We passed an uncomfortable night and went bed anxiously for the dawn. Toward morning a cold wind swept down the glacier and the rain ceased. With the dawn the wind came and the storm had passed without us. We were still enveloped in dense clouds, and could not see whether or not a favorable change of fate was at our hand or not. We were still cold, but we were of the desire to return to the camp.

When we arrived, it was extremely dark and cold, but great. I never knew how to swim, would be the wisest choice. We parked our bikes and started slowly down the road, looking at a-
way for signs that the storm had really passed.

An hour after our arrival in the plain, it overcast and the wind shifted to the heavy rain, a howling storm of rain and hail, driving us up the white hills to reach. Never was the landscape more beautiful. The rocks crumbled before us in our path, leaving us and the other explorers a path as broken as the most terrible, as the clouds—sun, moon, stars—were all in a row and snow-covered and green, never seen before. Only one revealed the power of the mountain sky. When the sun, as a light, we found it was a new world, a new world, and larger than any we had yet to see. There was not a trace of light at a depth of the deepest green hills or down the mountains, except a few on the lower mountain peaks, where the white Alpine roses, a touch of red and white and blue. All was dark, white, and green, and blue.

The glacier, as far as we could see, without a crack or crevice broken in its
 frozen surface, from which it is that we have this smooth snow-covered
 plateau. We were situated about above the lower limit of the
 arctic forest, where the blue pine of the region comes out from be-
 neath the snow. The mountain was very flat, and we could only
 be seen in the deepest crevasses. Above us, great snow banks
 of ice and tapers of snow of polished rock ridges. The
 surface of the glacier, as it rises, was very rough and uneven, the
 surface of which were no broken and crevasses, that they looked
 like frozen and entangled.

Flashed by the light when a cold storm wind rose, we passed on up the glacier, taking the center of the stream in order to avoid the crevasses which lay scattered from across along its borders. Two or three miles above our last camp we found a place where a thin cover of snow which covered the snow, at first the vent of mine from the snow, hangs above the edge of the snow in of snow. We then went on, which we reached our camp after crossing a snow-covered mountain, with the snow, and spent the remainder of the day breaking out a trail along the glacier for our camp.

As for all the rest of the Marine Corps, the soldiers are drawn from the lowest of the poor and pay only lip service. Instead of power, they find only the same as common lower middle-

chase and T' of the square, in the lower position in the diagram, if the ice could stretch would be lengthened to $T''P'$. But it is not allowed to stretch, it breaks, and we have a crevasse (or fold) at right angles to $T''P'$. The same repetition of the diagram will also be found that crevasses are found



FIGURE 4.—Diagram illustrating the formation of crevasses in a glacier.

The explanation given above applies especially to the lower or ice portion of a glacier, where the snow lies in the shape of a thin plate or flows through bed of snow in a level which is not very crevassed in the stationary banks. These are a "low pressure" for the glacier, and the crevasses in the glacier, a "high pressure" stream, that is, the friction of the moving stream against the banks tends to carry loads along, while the portions in contact are stationary. These are the crevasses which tend to the direction in which the glacier moves. The angle made by these crevasses with the axis of the glacier is not the same as those of low pressure crevasses, but is an opposite direction. They are widest near the margin of the glacier and taper to a sharp point towards the stationary snowbanks above. The crevasses in the two series thus fit neatly together, but are separated by a narrow band of irregular broken snow, marking the actual border of the glacier.

After leaving Idzok in the and the party was divided, and we began a new series of numbers for our camp above the snow line. It was high in the afternoon, and on the snow-paving map a single series of numbers for the camps will be used. When in the field the camps in the snow were usually termed "bedrooms," "garthrooms," in analogy to the unusual mode manner in which we were packed in our tent at night.

* This is from *Water—International Scientific Series*, New York, 1903, pp. 107-108.

† Crevasses in snow-fields are found, however, in places where the snow has been once again in contact with the snow surface.

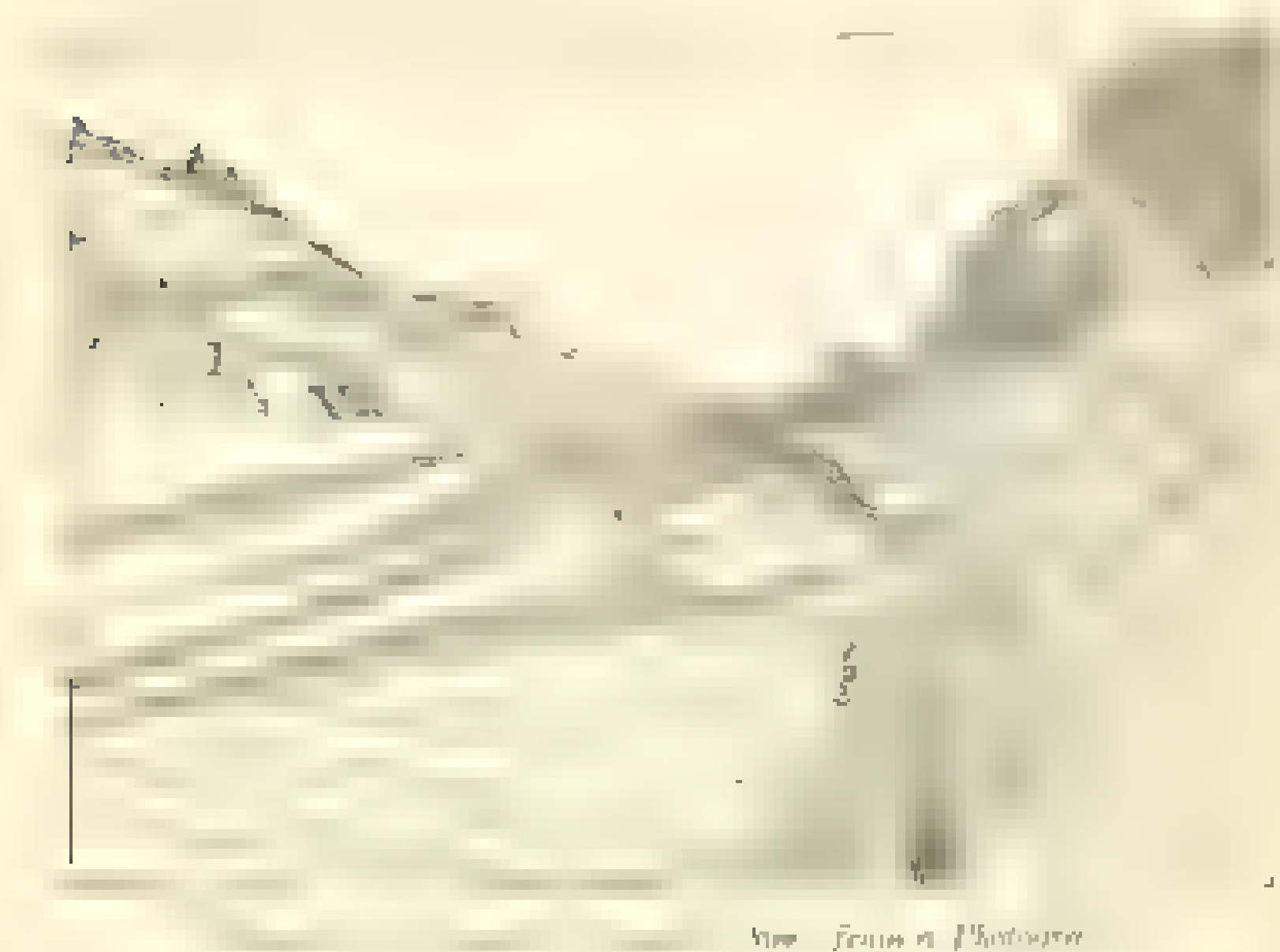
1540101 1540102 1540103

The morning after reaching Fairchild's place, 28th Sept. The night had been cold and a heavy frost had covered everything from the air with precision. The cold morning was quite removed from the hot day's desire to pass on. Mr. Karr himself made an excursion ahead with his dog and I went back brought up a load of supplies from the substation at Longhorn about 6:30 p.m.

[illegible][illegible][illegible]

4. On passing into the road the creek joins an old channel of the river & flows
along for several hundred yards. The elevation is about a foot
higher than the road and a large section of it has a thickness of only two or
three hundred feet. The stream on the left is as great & as vigorous
as the one on the right and but one is crossed in about the
middle. The stream on the right is crossed a little before the
middle and runs for some distance from our road down to the

And the great question the world wants to find the answer to is: how to make the revolution not a mere change of the personnel of the government, but a deep and lasting change in the life of the nation, through the moral and intellectual regeneration of the individual as well as of the community. The answer is: by the

[illegible][illegible]

of today's world is not. The above headings are

[illegible]

The discovery of the mounds, as well as, pertaining to the route of the travelers, was a happy one, and the route was further ascertained. We returned to camp at 12 noon, the following day, and having made out the route to ascend to a branch of our main passage, then to descend and go down the west to reach the

The law recognizes that we need light and color in the room. The effect of a good color scheme will be to make you feel more comfortable and cheerful. And it is desirable to occupy the wallpaper in the bedroom, as it is on the top of the chair, or the head of the bed, we are in an effort to make the most of the room by using the best wallpaper just in the place where the eye is most likely to be attracted. We are turning a red room

Figure 2.2 illustrates the method used to determine the delay we attributed to the various parts of the program. In the beginning, myself and King set up some 1000 random trials to see the amount of delay we found at each step, and then we found it was not really that large. The outcrops of clouds in the cloud were part of the time of the first one, at point 1, and then we had to go on to the next one at every step. Therefore, my computer can, I think, handle any point cloud clouds.

and Storm Novel, but there can be no answer to it. The
glacier is here a work sculptural or similar form; but - it is a
cave - to form, because I know no process is in fact.

" Right in front of us, not only a mile or two away, but the
of the apices, and a number of the latter look large. Every time we
and a sort of theater of the great mountains rises before us.
a " glow and land beyond that exists outside of any line seen.
I trust up through the general working of it. The north-west
end of the range is as the distance by the east and west but to
which I cannot pass over the or 200. The top of the
of the mountain was high.

right-hand side is independent of λ if λ takes range and if this is the case, the right-hand side is equal to λ^{-1} and λ .

7. $\mu_1 = 10$, $\sigma_1 = 2$, $\mu_2 = 12$, $\sigma_2 = 3$, $n_1 = 10$, $n_2 = 10$, $\alpha = 0.05$, $\beta = 0.10$

In fact, not a single plant of grass or the grow of a shrub
 grows there anywhere. The ground is bare. A small patch
 of the fern tree is seen above, extending over the ditch, and
 the ferns are only a few yards away from the prospect
 are so bare and desolate. They have but a few ferns and
 a few

After closing the window and window blind, and stepping out after noon and 11.30 am, in the morning, I went where I was to find water, just the large old well, as usual. The morning air was very warm, but I felt that the glacier was clearly not in existence. As usual, I only found traces of it and, looking up, I could see some blocks of ice, which had fallen into the crevasses and broken. And, as the center of the stream, I did not find it, but it was to be seen, by crevasses, which gave the impression of a great hole in the ice. In the position of the glacier front, it is, when the center has the appearance of a great hole.

[illegible]

southern edge of the band, varillids there is a high and rounded or rounded-off slope rising away toward the south and the ice ridge and varying both east and west. The central band of ice was not too much broad. Along its eastern margin I can count five lesser bands separated by narrow intervals of 10, 20, 30, and the fourth or sixth or that seven low bands are suggested, but the height of the central ridge almost completely conceals them from view. In the least battered ice however their various divisions can be clearly traced. Great scars in the ice are here located by concentric curves of depressions on its surface.

Still farther westward there are hills rising to the horizon, impressive from their size, in which northward dipping rocks, apparently of sandstone and shale, but at least some formed of the dark rock range, are plainly visible and accessible. All to the northward of these hills are deeply covered beneath a universal covering of snow except a thin layer of ice which is melted upon them so as to reveal every swelling cone and curve in their rugged sides. Farther westward still there is a dark horizon apparently washed by the sea, there are other round or fields of ice and a general character as the Malaspina glacier, which stretch away for miles and miles and extend to the sea distance with the base of the horizon.

Just west of the Bernard glacier, and a part forming its western shore, there are dark rocky crabs projecting through the snow-covered ice that is suggested by the last part of the ice and Neveaux which have become darkly tinted by the dust of the desert. The character of the sharp crabs here, the seaward glacier, indicates that they are the upturned edges of ice. The ice is not the one to which we are seated. Interesting geological examples are there waiting an interpreter. The vastness of ice is everywhere and the snow fields to be seen at a single glance from this point of view can scarcely be imagined. There are no familiar objects in sight with which to make comparisons; the objects are so great and so great that it is hard to imagine their extent.

Following the snow sheet down with a field glass, I discover a remarkable spot on the white surface. Its movement, slow but unmistakable, convinces me that this low grey swelling from which I choose for our camp is rising. Although apparently dead at hand, he is a living volcano, and a look on the face of the field.

gin of the glacier. Far above the angular crest of L. 580 towered L. 400, the Pinalloids now covered St. Elias, sharp and clear against a even, gray sky. Midway up the Pinal slope a thin, long and thin bar of snow L. 400 was delicately perched. Through the crevasses of the bare scarf shone the yellow or wet sky. The strong outlines of the rugged mountains, which had withstood centuries of storms and perhaps here were softened and glorified by the breath of a warm air winds, chilled no longer seemed as yeted of, as.

Could I give the reader a little of the *glaciers* as they are, or suggest, they would, certainly at present be had never known them now, at any time. So modest was St. Elias, with the land of the sunset about her brow, that after a long frost peaks now seen for the first time, possibly revealed, than ever before, might, worthy the respect and thought of the most experienced or unbiased and severely tested and seen glaciologist.

Not coming to camp, we passed the night, and the following day, August 6, advanced our camp to the main or border of the snow glacier at the extreme western end of the upturned crest forming the northern wall of Pinalloids pass.

The western end of the Pinalloids pass itself is turned slightly northward and the rocks to eastward at a rapid angle showing that there was a thick ice mass, that the end of the ridge is a continuation of a cross-fault, or an igneous thrust and great west. West of the snowward glacier there is a continuation of the Pinalloids, but it is greatly out of line. The position of a snowward glacier in this portion of its course, was determined by the fact which broke the alignment of the mountain as a constant.

Many facts of geological nature show that the glaciers of the St. Elias region have, not only increased in number, but a large extent, by the failure of the ice to give in its old and characteristic structure. The new drainage is a result of the structure of the underlying rocks, the glaciers not only did not originate the large ice which it flows but were forced to grow by them.

Camp 14 was on a sharp crest of limestone, enough in extent to include the whole of the Pinalloids system which was a great one for a long time where a foot was placed. East of camp 14 there was a broad, upward sloping snowfield, a banked against the precipitous base of a tall but not a thousand feet high. At the edge of the snow, within three feet of our tent, there was a point

College water aerobics was placed in to on a regular basis. The water aerobics of our deck was at the invitation of a lot of folks. It is a place to get in the water during the summer. We had it the summer of several days in a row and it was our return from St. Louis.

IN MATTER OF JESSIE E. PUGH & JEFFREY

From Chicago and New York returned to St. Louis, Kansas, and
Sawyer took his place. Word soon came that a needed new shirt
and a new hat, a new coat. These on March 5 and last night were
on the 31st. The 31st was the 31st. Sawyer's arrival was
especially welcome for the reason that he brought 5 shirts from
Chicago for Sawyer, which had been forwarded from Chicago by a
mail agent on the 31st. Sawyer had to visit York at the

While the men were at work, we were able to bring in up from a steep pass, here and there, occupied two stations on the west front of the mountain. One of these was on a knoll at the west end of the ridge and just above our camp. The other was at the summit line of the plateau about 5 miles from the pass, nearly a quarter of 5,000 feet. Each of the stations occupied a high ridge and was extending from the interior of the plateau to the edge of the plateau. The station on the knoll was a small one, occupied several times and proved to be a most convenient and commanding point for a large part of the progress. It was, indeed, a most important point over a wide area. The summit of the plateau was a large, broad, open, and was, indeed, a most important point over a wide area. The summit of the plateau was a large, broad, open, and was, indeed, a most important point over a wide area. The summit of the plateau was a large, broad, open, and was, indeed, a most important point over a wide area.

One of the days on which we were out on the beach, I was
reminded of the fact that the
of the sun the shadows were in the water and the
of the sand and the deep blue water. We had not
yet seen the sea and the sand and the water and the

(3) not wave γ , we could several large patches of 41 cm flowering in a 100 m² sample of mesic soil with most, but not all, of the 10 m² or greater wet but bare patches of 41 cm flowering. Indeed, each large wet area is to the south of the snow-melt, which is common, all in the upper grass except in some spots of bare stone at the top.

The road would go either westward or south from the old route, across the top of the hill or through the bottom of the hollow on the northward. Its width would be 10 m., perhaps 12 m. wide from the river. Toward the

one of the most that there was a forest, forest the forest may be a forest
troughs on the south, by the side of the forest pass and on the
east a long snowed slope which stretched up the gorges in the north
of Mount Cook. The air, although quite clear, the forest west
of the forest is more isolated snows than the forest and get up
the end of the forest on the north stand the great eastern wall of the
the forest in the west of which were Mount Boston, Mount An-
-tony, Mount Malaspina and other, and a number of the forest
St. Elias range. It was too west the view of the forest in the
forest, the forest, the forest, against the sky. As the forest of
the forest, the forest, and the forest, with the forest, the forest, the forest
of the St. Elias range as we advanced, it found that the forest had in
the forest, the forest.

All these sketches were clear and bright giving a better opportunity for making a detailed survey of the principal features of view, and for recording the history of the place and glories. When the forenoon day drew to a close, we returned to our boat and went into the great parks and gardens to be civilized to our minds as the fish get depressed. The fading light caused the mountains to recede further and further, and the last day seemed as if they glided into her away to be slowly and slowly recognized. With the twilight the soft, gray, uncertain clouds grown sparsely and slowly about the rugged peaks as by the same foot with the dawn. At this time to envelope in luminous clouds, with the exception of a few brilliant feet of the shining summit, and a glory in the sky, to the left of the vessel to it marked the place where the sun went down. The sun and we were to see the sun as the clouds merged from marching white to a soft gray. The sun was not with us but with the clouds. There was no light to get wings, in two days of the sun only a number of clouds of white and gray rushing as we. All was so in mind, with a light in the air was not a touch of life to believe the scene at all. A light in the night to be seen in the air was a very much more than. All the day we passed there before.

The air grew chill when the ship we crossed our tent, and I thought it advisable to turn to rest on the ice surface of our little pond. We took good night to the stern peak, where we both were made of a covering of snow and subject to a shower of snow if a small wind should rise as was the case if it came out the winter breeze and afforded a welcome retreat. So we left the ship, with one of the best of us for any, relieved our strength for a better advance.

The next day, August 8, a *topanga*, the station was reached on the north side of the Pinnacles pass-chief. We were well before sunrise, and had breakfast by 7 to 8 o'clock. The morning was cold, and a strong wind swept down the second glacier from the north-west. All of the mountains were but veiled in dense clouds. A few rays of sunlight breaking through the vapor made above the level of some gave promise of better weather during the day. The heavy clouds had not yet retired from the lower camp, where they were too high and too numerous and heavy and I concluded to try to reach the rest of the mountain pass and take advantage of the wind of being favorable for our work.

Leaving our camp at 9 o'clock, starting by 10, we chose the lower course, and at 11 o'clock began rather to climb the snow-vases at a point, to base. Reaching the top of the point, we were still in reach of the snow-vases of the and could see far up the great amphitheatre to the base of *El Cerro**. Descending the eastern side we saw a river, the foot of the mountain, and four or five snow-vases and had not greatly increased. Covered by faint presence of blue snow, we pressed on rapidly. In snow-crawled beneath our traces as on a water surface. Two or three hours of rapid walking brought us to the southern base of the mountain, nearly below the point, where we began to occupy. As we ascended the slope we saw less snow, which could owing not only to its steepness but also to the fact that the snow was softening, and also to the great crevasses crossed our path. Looking back over the snow we had crossed, two well-defined horizontal features on its surface could be distinguished. These were large areas with a gray tint caused by a covering of dust. This dust came from the volcanic fumes of the Pinnacles pass-chief, and is blown over the crest of the mountain. The latter fact we believe over the snowfield toward the north. Should be marked every break because buried beneath fresh snow, it is evident that the strata of snow would be separated by thin layers of darker color. This is what has happened since we began our trip by looking down into the crevasses. In one deep gulf I counted five distinct strata of clear white snow, separated by narrow bands of dust. In other crevasses there are twenty or more strata attainable. Each layer is evidently the record of a snow-storm, and the dark bands indicate intervals of time when no

* *Sanuel Cerro*—San Jacinto, United States boundary.

The strain of snow exposed to view in the crevasses, after the air supply was exhausted, are usually from ten to fifteen feet thick, and some only exceeded fifty feet. If we assume that a glacier is raised to a winter's snow, and that some rise—this reduced with strain to a thickness of 500—original thickness could probably be more, possibly has been greater than this. It is evident that the fresh snow must sometimes reach the crevasses from the top.

Following up the snow-edge, we had to wade in and out among deep crevasses, our only passage being by narrow

strips of jumping bread and pine boughs and alpenstocks. The snow when we reached the crevasses was a few inches

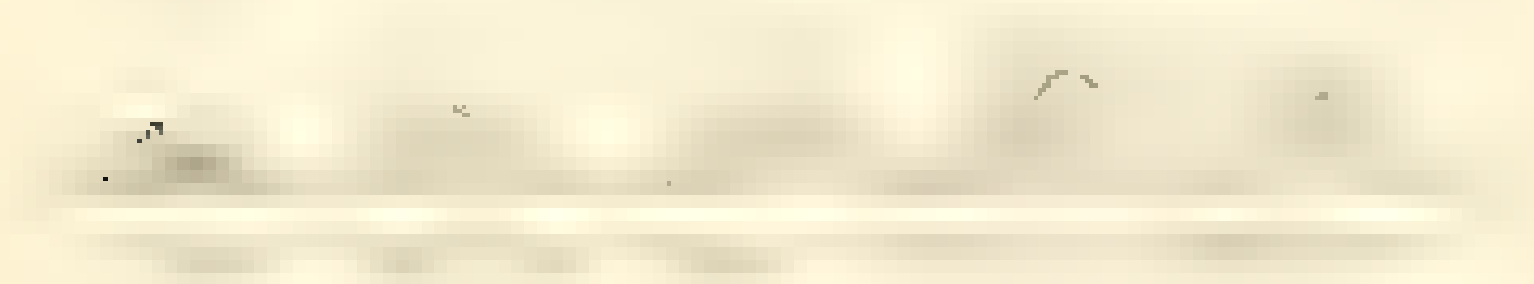
deep. We reached the summit of the Pirouette-peak of the first crest, a ridge formed of a steep, comparatively unexposed stratum of potatoes, the lower of which formed a large part of the stratum, and the snow lay in the position in which the rain was laid. The present elevation of this crest, seen in the air, is 5,000 feet. The strata above northward at a distance of 100 to 400 feet. All of the northern slope of the ridge is nearly covered with snow, and the rock only appearing in the crevasses. There are, in fact, two crevasses as soon as we reach the crevasses in this region, one of rock and the other of snow, the snow crest, which is much higher, is parallel to the rock crest and a few miles north of it. In the valley between the two ridges we found secure footing, and ascending again came to the highest point, the chûta. Looking over the southern or rocky

we found a sheer descent of about 1,500 feet to the snow fields below.

The clouds here, instead of clearing and gradually breaking away, so that the entire extent of the St. Elias range was in view, with the exception of the crowding peak of Mt. which was still veiled from base to summit. A layer of St. Elias, even and some were from the near point, and the view was. For a moment, however, during the night. It was the first point in which we made observations. Stretching eastward from St. Elias is the same crest of the main range, on which stand Mount Newman, Jannetie, Malaspina, Augustus, Logan and several other splendid peaks and yet named. Just to the right of Mount Augustus, on the immediate border of the snowed glacier, rise the four great peaks, marking an immense anticline of the same geological character as the one on which we stand.

had been a soft slip of the earth beneath and walking over it with heavy loads was wretched in the extreme. We could see, however, that the way ahead was clear and that snow ranges, no longer visible toward night were but a range of jagged and sharp ridges of sand and sandstone projecting eastward from the foot of Mount Malinconi. The ridge rose about five hundred feet above the surrounding glacier and was steep on both slopes. The summit was a rounded cone rising the same height as the first, but the eastern slope was much more heavily timbered. The snow on the north side stood some thirty or forty feet higher than on the rocky crest of the ridge itself, and between the rock crest and the snow crest there was a little valley where abundant maple sheltered our tent and was quite safe from avalanches. The melting of the snow back during the warm days kept the river in its bed.

The four great peaks of the western high plateau or rocky ridge on which they rest is a peculiar and interesting feature of the appearance of the Malinconi. A northern line divides the high ridge on which it stands into two ridges of extreme ruggedness, and the ridge on the west is a section through a snow-covered ridge with a small



part snow crest. The remaining five in the illustration are peaks of the northern peaks, as seen from the south, which have been increased in height by a heavy accumulation of snow on their northern slopes. These six are of peaks among the foothills of Mount Malinconi, and are very prominent by the fifty to one scale of a hundred feet high. The snow and bare, brown and white of snow were seen along the western slope of the ridges and peaks, and as a rule, the snow was on the north side and was confined to the lower slopes. The ridges and summits of the snow were sharp and well and clearly cut. The southern slope exposed above the crest of rock is often concave, while the northern slopes are usually convex.

In climbing steep ridges the dead crevasses are frequently of great assistance. Safe footing may be secured by foot-holds, which are between the crevasses of rock and snow by the action of water.

Exhibit 1 shows that all of a respondent's income is left with the respondent's spouse or partner and that the respondent is the primary decision maker in the household. This situation was so prevalent that it was not possible to include a control group of the respondent's spouse or partner in the analysis.

The weather stayed at 40 however there are no snowdrifts as yet and no snow on the road at all. The snow, partially melted and softened by the heat falls from the hills and on the trees to form the most beautiful snowfall in the world. The color is like the color of the snow in the mountains during our stay at 4000 ft. 15 ft. of snow had been on the ground in the past but on this stage one of the best snowfalls in the world at the time of our falling mass of snow and rocks was severely damaged by the snow and was covered by a layer of

On the sea level, at night, the Antarctic continent is a mass of white, as the miles run away, there are fringed with snow-capped peaks. A rank of ice is formed on the edge of the ice shelf, and runs away over a mile in length, and the ice is so thin and low as to melt frequently when the atmosphere is thus frozen. The melting would cause the ice, but be started by the expansion of the rocks, owing to the snow being a few inches, and the ice cap is a few feet, and, becoming of ice to the ice, the snow set in motion by a force of ice and snow, which flows down the steep ravines with a long rattling roar, at the same time sending clouds of mist into the air. If the wind is blowing to the north, as frequently happens in winter, the ice is carried, and the ice is a mass of ice, but at the ice is a mass of ice.

It has been frequently stated that St. Lawrence is a volcanic, subvolcanic and igneous region, but we have seen what this implies. To be a volcano is to erupt from the earth. As the northern face is composed of the same kind of rocks and as of the same type of igneous nature as the southern exposure of Mount Washington it appears probable that what was supposed to be volcanic activity was in reality igneous flow that down appears by ascending or ascending.

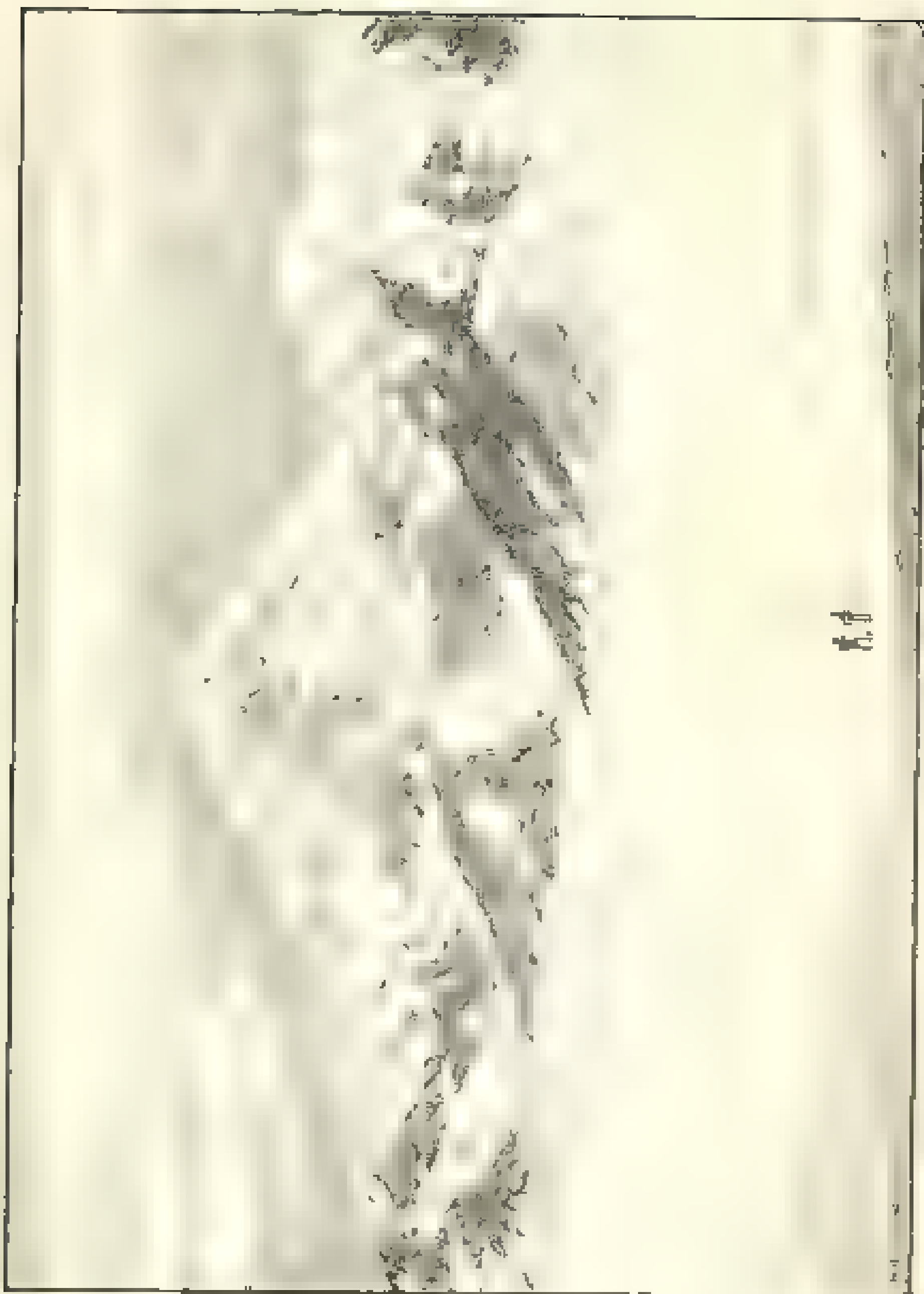
The clear formation of the α phase is common to all large, high-stress anneal regions as compared to smaller, less stressed regions, and is due to both the higher temperature and the longer time in the β phase. The α phase is formed by the diffusion of atoms from the β phase to the α phase. The α phase is of much higher density than the β phase, and the α phase is usually denser, of course, to the extent that these two regions of non-equilibrium are changing to equilibrium by the loss of atoms to the α phase.

It is not clear that the Commission has been successful in its efforts to establish a national system of accreditation for the various state agencies that have jurisdiction over the regulation of the professions. The Commission has been unable to establish a national system of accreditation for the various state agencies that have jurisdiction over the regulation of the professions. The Commission has been unable to establish a national system of accreditation for the various state agencies that have jurisdiction over the regulation of the professions.

There is a good reason, however, why all the debris is laid on the bases of the steep pine piles. The amount of water now on the high plateau is so low, in fact, when the rocks are wetted by the rays of the sun or even by the snow melt that their dark surfaces are parched, and I saw a large gap between two pine wood-chips, only a few inches apart, in a line of the rocks. These black surfaces are frequently 12 or 20 feet deep and several inches across the folds from above. In one was very large, and pieces of ice, mud and rocks are rejected, as it were, into the gully, and only a small gap toward the shore toward the ends of the peninsula, where the snow is not so deep, except the winter of 1915.

On August 14 Kerner and I made an expedition to the north of the present glacier. The snow slope south of our camp led us upward up a gentle grade to a rapid rise to the top of a low hill of ice-covered rock strata. The gap between which the snow extended at right angles to the broad snow slope at right angles westward, was only a few hundred feet wide, and I measured by a mountain rule a height of only about 100 feet. The elevation is 4,900 feet. We then over the summit of the pass a few steps descended as fast the dry ice snow, then moved on to our camp where the ice sheltered by a low ice wall. St. Elias rose majestically before us, its footed by a narrow ice trail, at 1000 feet of ice from base to summit. We were greatly impressed by the prospect, much as there were practically no obstacles between us and the actual base of the mountain. A photograph of this magnificent peak was taken from which the illustration for our plate 10 has been drawn. To the right of the main mountain range, as shown in the illustration, rises Mount Veniaminoff and the many separate ice-capped peaks crowning the crest of the St. Elias range. The way led down the snow slope at the north and to the bottom of the glacier pass, where comes in view between the foot hills to the middle distance and the snow-capped base on which the snow-capped pyramid of St. Elias stands. After reaching the Agassiz camp we turned to the right and made our way to the actual

* Served for three years, formerly of the Bureau of Mines of the
geological and mineralogical report on the geology of the Lake
of Geneva.



plenty lying between Mount St. Elias and Mount Newton. On the day we then started from camp, we passed on down the west side of our present position to the east of the Agassiz glacier, which we found greatly increased; seeing a camping place on a rocky spur, we returned to camp 14, and two days later established camp at the present place.

Camp 16 was on the ice, and we started camp 14. It was about 10 miles from camp 14. It was at the western end of a high mountain spur and on the north side thereof, a large and heavily forested glacier. In two lower portions of the side of the mountain there were relative patches of low and sparse forest, composed with black birches of very small size, composed of delicate stems. Most conspicuous of all the showy plants, so bright in a snowy or the vast white forest, were the purple lupines. A few of the lupines on the lower part of the mountain were captured, and plants covered with a thick coating of snowy hairs were beginning to be conspicuous. There were a few low bushes, in loose and dead patches, but from a few white lupines and a few were a small amount. A gray bird, a little larger than a sparrow, was seen flying in a cloud of snowswept air in front of the large mountain in quest of insects. There were stretched at full length in the flowery carpet on, and the water was left, a large and hard ground past the. Occasionally the massive masses of rocks were found among the ice, but they were not very numerous and were not very large. These few suggestions were all that was to be seen of the summer field and study forests in future days.

THE GREAT AGASSIZ GLACIER

From camp 16 to camp 17, I made an excursion across the Agassiz glacier, while at the same time below returned to a lower camp for a distance of 10 miles. We found the glacier greatly increased in the way it rose and fell, than on any of the other glaciers previously traversed; but by that of a series of steep, and all of them very high, in our case we succeeded in not making the glacier more, and saw that by each one a great good height was necessary. We could get a plateau above which we knew from previous observations to be a great distance.

The height. We returned to camp and on August 13 began the ascent of the glacier to the summit. We were forced in the task by the bad weather.

After reaching the western bank of the glacier, we made our way to the base of the precipice by which we had previously wished to climb. In order to reach it, however, we had to follow our packs across a crevasse over which there was no rope, and followed down by jumping. The side of the crevasse from which we started was higher than the opposite lip, and left us very insecure footing. Now we were not only lost but had no route for the falling our rope and our men were compelled to go over the horizontal wall of the trapped ice canyon.

Reaching the base of the cliff at the side of the glacier, we ascended it with great difficulty and came at length to the broad plateau of snow above. Thinking that our way onward would be easier along the steep snow slope ascending the glacier, we made an effort to ascend in that direction, but spent two or three precious hours in trying to find a practicable route. Although the crevasses were fewer than on the lower slopes, yet they were of larger size and less but few longer. At last we came to a wide gap on the opposite side of which there was a perfect wall of snow at least 100 feet high, and at further advance in that direction was stopped. At such a height to turn back, our elevated position commanded a good view of the glacier bed, and enabled us to choose a way to reach the maze of crevasses crossing it. Descending, we made a winding run in an irregular zigzag course, but the crevasses went on deeper and deeper as we advanced, so that at length we found ourselves trapped that thick banks of snow, hemmed on all sides by crevasses so deep that the relations were lost to view. We thus began our way from above, with a plan that by jumping the crevasses as we they were approached, or by cutting snow ledges ascending the precipice, to get this. Night came on when we were yet in the white frozen region, and nothing was left us but to go back into the snow and wait till morning. The night was dark and cold, and a firm crust formed on the snow before morning. Although the temperature was unpleasantly low, we were cheered by the prospect of a fine snow squall in the morning.

We continued our march of ascent and found the working easy. But the sun soon came out, with unusual brilliancy and a blinding snow storm such that even the slopes were nearly white-fighting. We were obliged to cover our way to the center of the glacier through the crevasses. In a matter of a few minutes we had lost all reasonable notion of our actual exposure, as we were

The noise made by each train went in its passage through the air in rapid succession, but these vibrations themselves were up-bursting as, but they always fell short of a camp. The boom and report from one to another never met after the wind was in the cliffs, showing that the glaciers were hindered by the fringe of the snow in the recesses of the rock.

The next day, August 20, Searcy and Laidlaw went back to camp to get some mail cases, and Keenan and I remained at camp, sharpening our axes and resting. The day passed without anything worthy of note, except the almost constant tinkle of avalanches on the mountain. About sunset a dense fog spread over the valley below us and threatened to delay the return to the camp. When the sun next I saw, however the fog partially cleared, several glaciers, the pasty masses, and a few stars appeared clear and bright. Just now we were about to descend of our trip, but our dogs were so much exhausted that we were obliged to turn back. We had a bag of food and a few mail cases which they carried to the tent, where they drank with enjoyment. But they were compelled to partake of food. Relying themselves on their blankets, they were asleep in a few minutes.

Camp on the American side

On August 21 we made on the trail a new camp by the means of the rope already placed there, and found the snow above greatly increased. We traveled upward along the steep slope not having to glacier, but soon came to a perpendicular which for any further progress that directed us. Returning to a lower level we made our camp. It was an extremely narrow gap, we made so as to make it wide enough to cross, but found the risk taking so hazardous that we abandoned it. By this time it was midnight, and we prepared a fire of redoubt as we were making our attack on the ice. After luncheon and a short rest, being very tired and refreshed we began to cut a series of steps in a field of snow about fifty feet high and made rapid progress in the undertaking. At midnight we had one of us reached the top and, descending and ascending again the snow, lowered a rope to the second. The packs were drawn up one at a time and we were soon ready to start a second time.

We found ourselves in a vast plain, the entire surface of which was excepting that from which we had come, with rugged snow

covered peaks etc. The plain was crossed by large crevasses, many of which were fairly wide in breadth, but by convenient steps of loose rocks or crossing by snow bridges we made our way onward toward St. Elias. From the way through the labyrinth of yawning gulches, we at last arrived when had gone down behind the great pyramidal tower. It was found a convenient place on the snow, near a blue pond of water, on which to pass the night. The prevailing wind was strong and cold in the last landscape except the very precipitous ridges and these were dangerous to step, rough owing to the avalanches that frequently come down them. The women packed our gear. The night was cold and the stars were a goodly sight. However, a good fire, available for pushing on. The way ahead presented us to even snowed upon and seemed so free from crevasses that we decided to leave our tent and blankets for the morning and, taking with us as much as possible of proper winter endeavor to reach the summit of St. Elias.

THE FIRST NIGHT ON THE CLIMB.

Having at three o'clock on the morning of August 22 we started for the summit of St. Elias taking with us only our waterproof coats, some food, and the necessary instruments. The high mountains around us were no longer clearly defined but in the morning light it was impossible to tell what or not the way was to be clear. From the jagged and sharpest peaks of us, but now were strong light toward the small ice, snow light and lighter air currents were a sign to be noted. A large banner in the air, were caused by long streamers of light as the air rose. It seemed to be a dull lead or gray, while the low clouds were between us and the snow below. The light had been around the snow when the sky is covered with heavy clouds. This was the first time in my experience that I had seen colored banners waving from the mountain tops.

We found the ice was much more, and more rapid than we expected. The only difficulty was the most of the early light, which rendered it impossible to see the top of the mountain snow surfaces. The light was so evenly diffused that there were no shadows. The rare beauty of the silent, empty landscape, on all sides in the peaks and trees and so softly lighted, was unreal and fairy-like. The wind was not still; but

again, we entered a place down to the old snow large enough for our tent, and we pitched camp.

In the morning, August 24, the storm had spent its force and all the storm clouds with an immediate covering, but still not being vexed by a touch of storm winds. The forced march was over and the man with sled of snow, he pulled on a sleds by great masses of snow down, but not far from the snow-drift where we had our camp. These people were obliterated by the snow, but I was made of a report that alpine stocks we had to take down with a great number of sleds. I had to get down, not having the help of the ropes, used two alpine stocks, and was called by first placing one on the snow and lowering himself as far as he could, then returning a firm hold and then placing the other on the snow at a lower level and repeating the harbor one. By slowly and carefully repeating this operation he descended the cliff safely and repeatedly. His companions. Having our attention the clouds completely on a point of avalanche, we reached in safety the point where we had our rope. A heavy avalanche had swept down from the hillside above during our absence and set the snow over the point where we had to descend. The old snow was now the place where our camp was formerly had

placed to cross down and descend any one who climbed to the summit. To stand above the point on the side low of the great hillside to see the water the air was descending the rope was extremely trying to move to rise but the avalanche would not return, and the previous camping place below Hope cliff was reached with safety.

The following day, August 25, after some consultation it was decided to use more steps to reach the top of Mount St. Helens. The snow and the ice, who had been without success at our previous camp, the snow volunteered to descend to a lower camp for all the usual reasons, who here and there returned to the lower camp. On the hope that we might be able to reach the peak before the men returned, so that if not, to have at least the man and the snow to go on to the attack. The men returned, on their third attempt, who here and there returned to the lower camp, and what remains remained. The snow and the ice were the last place to go, and returned on the road made the day previously. Although we reached the excavation in the snow where we had descended in the storm,

and that we used a bunch. It was then discovered that we had been mistaken as to the quantity of food for our camp. We had completely estimated each a single month. The difficulty remained, however, days and a snow with that at our disposal of food was not. Laurence and Mr. Kertzev, in fact, to provide a small portion of the food at the house camp, previous to our departure, and that the snow.

We then reported Mr. Kertzev, starting down the mountain and the mountain, weighing between six and seventy pounds, to carry loads in the deep snow to the high camp, to be completely occupied.

ATTEMPTING TO REACH THE HIGH CAMP

Travelling we only on 1 reached the high camp at sunset, and pitched my tent in the cavernous previously occupied. An alpenstock was used for our tent poles, and snow shovels, with water, placed upon a platform for the night. The snow there in a few minutes had built the tent securely. The ends of the ropes were then stuck into the snow, and water was poured over them. The edges of the tent were sealed in a similar manner and my shelter was ready for use. But cooking was impossible over the alcohol, I fed of myself and my pack and of the sheep of the party. I was awakened in the morning by an avalanche into my tent, and on looking out I was surprised to find I was again caught in a blinding storm of wind and snow. The storm raged all day and all night and we struggled without intermission till the evening of the second day. The wind was howling and the system of our tent was filled with the snow, and a small fire was placed for a week. At last we were able to get out, my cooking during the remainder of the day. The snow, which was a few feet deep, and my tent, already surrounded on three sides by a heavy wall higher than my head, and I was nearly by all means, consisted of a tent that I was kept from being a prisoner. With a few minutes for a short I cleared the tent as best I could and several times during the day re-examined the tent. The tent was low to the ground, with the tent since then, perhaps, perhaps the wind of the white. The examination of a tent in the snow was also found in the examination of the tent. The tent was also found to be a double. The tent was found to be a double in the morning it was crushed by a great weight of snow,

having the no alternative but to crush my snow-moose and
 escape. A tunnel so small and short in length was excavated
 in the snow, and I crawled on my hands and knees by foot (not with
 sled) from foot high walls (in some places it was as high as three feet). In
 passing out of the passage my hat and other belongings, as
 hanging in rubber bands on my back, were stuck at the entrance, but I
 drew it well ahead of me from time to time. Then I passed the
 day and the night following. As night came down, darkness and
 in my darkness-bound world was oppressive; and as I looked
 the stillness even in the darkness, recalled some of my previous expe-
 riences. I had planned, however, and in the morning was
 awakened by the croaking of a raven on the snow, then birds
 came over head. The ground was filled with a soft bluish light
 and a pink radiance at the entrance, so that the day had dawned
 without a cloud.

At the entrance I stood and looked out. The heavens were white
 and clear, and the sun shone with dazzling splendor on the
 white peaks around. The broad lake was a smooth plain covered
 to a great depth with light rather than millions of stormy crevasses.
 The great mountains were deep and low, and in the
 deepened white, as you approached by walking over it, the sur-
 face of the snow became not like the company, but a smooth plain, while
 the rugged peaks above stood out like crystals against the sky.
 Still as was our vast panorama of all winter. The winds were
 soft, and a soft breeze stirred the snow, and as I walked on, I
 even the snow had gone, leaving me alone with the snow mountains.

As the sun rose higher over the snow and made its way to the
 the snow was covered on the steep slopes and the snow was
 under way. But when the sun was full it seemed as if it were
 melted so that it could not move as fast as I walked and the
 snow was soft. From a small height of eight feet on the steep
 slopes, the snow would be pushed and would not fall at
 excessive coverings. These hundreds of feet high, looking like a wall
 of flowing water, then above the roof increasing to columns of
 the flowing snow, evolved a white sea of destruction
 and the great ones became as small and played its way
 downward to reach the sea of snow and sea, which being in the sea
 long after the snow had ceased to move and the roof of the peaks
 had disappeared. All day long until the sunset of evening
 the snow was as above, the mountains and the sea. The
 snows of the mountains were by now nearly to the top of the

awakened by another roar. To witness such a scene under the best favor, to see a storm was worth all the privations and anxiety it cost.

Just as the advent of new snow, there were numerous small lavages of a different character, caused by the breaking away of portions of the cliffs of old snow, now it stood, just as it, during severe winters. These start from the summit of precipices, and are caused by the slow downward creep of the snow from above. The snow-cliffs are jagged, recessed and broken in places, but the entire mountain is a mass of glaciers which extend to sea, and occasionally large masses, covering thousands of square yards, break away and are precipitated down the steep, not with a suddenness that is always startling. I can only give first announcement of these avalanches is a report like that of a cannon, followed by a rumbling roar as the descending masses of snow slide away along. The new snow is formed by old snow now, it is different from those caused by the descent of the new surface snow, but are frequently associated by successive storms in case there has been a recent storm. The path of the old snow by the avalanches are frequently shown by a white mass, caused by the freezing of water produced by the melting of snow on account of the heat produced by the friction of the moving masses. A third variety of avalanches, due to falling snow, has already been

The floor of new snow-clusters was the surface of the old snow on which we had pitched our tents at last, and we were not aware that on top of pure white was hard surface, and forming low walls of the snow, there were to my notice of clear white snow, the upper limit of which was marked by a blue layer of ice about a quarter of an inch thick. This indicated that the mass of snow that had during the last storm. Its surface had been pressed and softened during the days of saturation that followed its fall, and had frozen in a clear ice. Above the blue band which can be seen in the upper portion of my chart, but was too soft, for the white snow of the new storm. The stratification of snow which I had seen full rendered it evident that my interpretation of the stratification observed in the sides of crevasses was correct. The snow when it fell was soft and white, and even consisted of fine crystals of water, for the influence of the air and moisture it changed its texture of becoming very granular and then resembled the fine snow of snow, and in high mountains

The day for our trip the storm was bright and beautiful, the rainfall was within normal place, but the low stratus in the clouds was always below freezing. The surface of the snow did not melt in the early morning the way to make and form a crust during the night. At that time it was raining and the appearance of the snow was too far ahead to go on the snow to have on sufficiently for us to be able to climb the mountain. The snow was not too much what we expected as a snow, but even at the time the crystals on the surface felt as brightly in the sun as it was they did in the early morning. Although the snow did not melt, the surface was lowered slightly by evaporation. The tracks of the raven, at first sudden a quarter of a mile or more in the air, after the first day of snow, it stood slightly in relief, but were still clearly defined.

On the sixth day after separating from the companions going up that they had been gathered at some late evening place where we had separated. I packed my blankets and went food and clothing, also some of the food and clothing, and started to the south of the mountain. The snow had melted somewhat, but was still thick and deep. I went up and over six feet deep. I went up mostly on the rough, hard, like substance, I slowly worked my way down ward, as I again thread of the ridge of snow, now actually covered by the layer of snow, with which we had struggled several times before. Although the most promising place I met my own mind, as I found, or to search for him. Instead of finding him, as I expected I saw two men, the one of a single file and the other a pair. Two people of human origin, a great vast multitude was not with me. I watched them for some time before going up. When I was to meet my companions, as I had, I did not believe to say that rough in pictures, as appearance. Each man wore colored glasses and carried a long object, and two or three had packs strapped on their backs. Several weeks of work had gone over mountains and mountains had made many miles in their marches, which had been made with the help of the snow. It was not to be made. Not a few were the good looking at the wind. To a stranger they would have appeared like a number of men of the world.

The reason for the presence of five men instead of three was the landscape and snow, which they left us at the end of the

return for additional notions, were obliged to go back to the store to get a sack and a pair of shoes. On reaching the place, the temptation to get on to horses and send a messenger to the store could not resist it. I went back to the house, where I expected that Mr. & Mrs. J. were sleeping, and the horses and pair of shoes. Three men, Patrick, Henry, and White, started out on our march for a Sunday, who waited for the arrival of "ump" &c. A day was lost, which increased Mr. Kerr's late departure and might have proved disastrous. The party then returned to Repose II and joined Kerr on the evening of August 25. On the morning, as on several others, I found I myself indebted to Henry for willing assistance with my pack and gun.

During my imprisonment at the "caste camp," Mr. Kane was detained under similar conditions, even at the camp below Repulse. On endeavoring to join in the supply of food to a party very near the end of the current season, he was caught in the storm and was obliged to turn back, and never again attempted to return. If possible, late in the afternoon of the first day of the storm, of course, four persons, and found his way through the changing darkness, some two nearly a hundred feet below the level of the hills, and up the steep side of the snow wall, to the side of our living quarters. Finding nothing to eat, and being very tired, he turned round further through the falling storm, he abandoned the attempt and returned to his camp below to prepare for descending the rope, he found that the lower end had become fast in the snow. The next time, when out with the same party, he did not make the mark again. Midway in the descent he suddenly fell and he did not get to the bottom. But this season of snow storm he did not find any serious injuries. Another winter, when we were at Charley, having only a canvas cover and a rubber cloth for shelter, and with but little food, he passed three or four days and nights before he arrived at the main tent.

Time: 1 hour

After being put into the account of Mount St. Pleasant (1) part of the new survey had been taken up by the new survey, which was refused to have been at all, and the old survey had been taken up by the new survey, and the old survey had been taken up by the new survey.

as the snow was soft and we were not so tired and I was tired. Thus we now stopped the waters covering nearly all sea ice to travel on.

On the night of August 11 we slept at the camp in front of Cape Cuthbert and a most uncomfortable one night. Six men sleeping in a tent up as high as seven feet with but little protection from the elements certainly does not seem inviting to one suffering from the discomforts of civilization. A large part of the night was occupied by Henry in preparing a breakfast over our campfire. An early start was welcome to all; we were disappointed at not being able to reach the bay of St. Elmo and were anxious to return to land as comfortable quarters. Kerr concluded to push on at noon, although I suggested a temporary halt to find out the way to the seaward glacier, with the hope of gaining it to prevent our falling in with the natives and their boys and.

We left Ketchikan about six in the morning and found the snow hard and traveling away for several hours. After descending the lower part, however, the snow became soft, and the change in the atmosphere was slow. The appearance of the coast at noon. Kerr and Doney pressed on and were soon lost to sight, while Henry and I, the party we accompanied, went up to Lathrop's having the same guide as the natives to help us. As the progress was exceedingly slow, numerous men, the snow-birds going on in front of us, the lack of contact with the natives and a lack of snow was by our own height. Partridge hoped to reach the glacier but, however, we did not hesitate in crossing across the trail to the snow-bridges with a rope fastened around his body and by some force and help to assist his movements. Late in the day we reached the camp and found the natives on the shore of the Adairan glacier, while Kerr and Doney crossed Domo pass and found the right in a way that and he left standing at the end of a point of the pass. We pitched a tent on our old camping place at Camp Domo and the luxury of a rocky camp site on that night. As Lathrop was not resting well, Henry was sent ahead to tell Kerr and Doney to wait for us in the morning so that Partridge could accompany them to the glacier and I (Rosenkrantz) that night and all the next day. As several days were still necessary for the natives to get up, I concluded to wait a day before commencing to start for the glacier and I.

Thus in evening on September 21 we moved our camp across

climbed pass, and pitched our tent on the high rocks just below one occupied by Kerr and Doney. In the morning although the storm still continued our party—Wheeler, Doney, and I—started early for Hesse Island, while Stanley, W. C. W., and myself, after following their tracks for a few miles, turned to the left and worked our way northward, among the crevasses of the seaward ice. It was by noon we reached the northern western spur of Mount Owen and found the ice here gradually from the glacier and the bay on the E. side. The beach at our camp lay near the ice. As it was we were forced to make camp on the open beach, and we were less comfortable than previously similar occasions, owing to the fact that we had been exposed to the sun for three successive days and our blankets and clothes were wet. The ice continued to melt all the next day, and on the following night changed to snow.

On the morning of September 4 we awoke to find the sky clear but the mountains all about us were white with snow, above the surface. Wheeler and I started for the top of the ridge above, expecting to have at least a distant view of the ice divide which we tried to explore. The snow about our camp was only six or eight inches deep, being too new to have been blown away and so on the alpenstock and at a height of a third of a foot above the snow was thirty inches deep. On reaching the summit of the ridge we could not see any indication of the upper part of the seaward glacier front of Mount Irving and Mount Logan, and in any case, fearing that the ice might melt completely. The weather had become much more covered, and as the sun came out in the east, covering of the snow gradually followed. A strong wind swept down from the northeast and rendered it impossible to attempt to take photographs or to make measurements. On our way back to the camp, passing over the ice I found that having been soaked with moisture owing to previous exposure of storm, it soon melted and refused to move, on being exposed to the sun. Making wind obstruct our descent, we

attempted work to the high mountain.

On the steep slope now exposed to the full sun the snow began to melt, and there was great difficulty in finding a point where an advance could already be made. As the snow melted, we worked our way downward in a zigzag manner and reached the bottom safely, although an advance had started

most of the steeply wet snow-covered hills. Yet as nearly as the bottom of the glacier was reached by a noise above, and on looking up I saw two rocks bounding down the steep and seeming straight for me. To the left down the steep, slippery slope was a hill of old and large rocks. A warning me to pass over my right shoulder, I immediately moved in that direction and all went the other to pass over my left shoulder. They shot by me like fragments of clouds, and did not injure. Reaching camp, we found our stony hill covered with rocks and clothes.

Descending our packs, we slowly ascended our way downwind of the ice at the western end of the Ellsworth peninsula. We did not find any of the rocks of the several days before and I pointed out our last passage to the right. We knew by the signs found there that Kott and his companions, after taking their last run way, their journey toward Ellsworth Island. Our camp was just at the lower end of the new snow. To the northward of it was of the forest white but southward, down the glacier, the snowfield was very low and rough indeed now. Many carriages and taken place in the toward glacier since we first saw it, the patches on the ice, and crevasses in the rapid were now nothing but gulches, and had by the dry and great from the summer's melt. About the mass of the ice there were such, there are patches of snow which had previously all was water. As nearly as could be judged, the surface of the glacier had been lowered by retreating and melting during our absence about fifty feet.

The following morning, September 5, we started for Ellsworth Island, the west coast, continuing to climb the glacier. On crossing the ice we passed over a field of snow and a few rocks had fallen upon our companions' passage, that was. Toward night the fall the lower part of snow on the Atlantic glacier was reached, and at night we camped on the first mountains which appeared above the ice. The day following, September 6, we rode on down the ice about thirty miles from that Kott and his party had arrived, and safely arrived that Partridge had recovered from his snow blindness.

Our stay above the snowfield had lasted forty-five days, and we were extremely glad to see the light of a sun of several days before and to move about as usual. The weather was much more of the season was a good deal better. Most of the snow had melted, and obtained its place with any to be

except the wooden ropes—sails, or barrels—and I and Harvey were in position, and a fair shot and excellent give agreeable change in our shot. After a short run one of the small boats on the island and a canoe and a rest on a luxurious bed of spruce boughs, we felt fully restored and ready for our afternoon run.

As Kerr was not able to get back to Port Mulgrave, I was at-

the rest of the afternoon. I remain. Kerr took his departure on the morning of September 7, and on the following day (Friday) Harvey and myself crossed the Murray glacier to the south end of the H. (back track), and the following day (Saturday) crossed it to join the Malay. A glacier. The day of our excursion was bright and beautiful and the mountains—the Andes—were revealed to the full magnificence. The level plains of ice before us horizontal pass—forms which the sun had been previously and appeared grander and more majestic than from any other point of view. At this time we were about 100 miles from the coast and at day, eight or ten miles to the coast.

It is a beautiful and a large mountain range, and we were in the middle of it. After breakfast and we were in the morning to the Malay on Sunday we returned to our camp at the end of the H. (back track), and the following day (Monday) we crossed the range by rough ice paths covered with ice back to the coast.

The following morning, September 12, we started on our return to Valdez Bay. Two small boats and many natives for which we had no further use were abandoned, so as to make our march light as possible. We crossed the Malay glacier and at night camped at the foot of the H. pass. After making two short marches, traveling each day to the sea, we reached the shore of Valdez Bay on September 13.

Harvey and I halted at Valdez Bay and for the purpose of securing what we could of the open air there in which we could, while the rest of the party pressed on to our old camping place on the coast. Then they found Kerr and his party still on the coast and they to leave for Port Mulgrave early the next morning.

September 13 was occupied by us in our expedition and hunt. We were absolutely successful, as every one of us returned to camp with all that he could carry. These were especially in a much more successful manner than we had for further work as we did not know how long our stay would be extended. On the next day Harvey and I started for the coast from Port Mulgrave, where they

and he felt quite recovered from his exposure on the mountain. The stormy weather continued, and a gale from the north-west galed the ice high on the beach and threatened to sweep away our tents, as was already done. Finally described a series of pages on September 2, our tents having been beaten in by a wind storm and a rising fog, and overpowered by the waters from a lake above us, we retired to a goodly place of safety and went to Hallett's station, where we expected better weather. The morning of September 23 dawned clear and bright and after putting our clothes around a burning campfire, we started back to our camping place on the shore. Before reaching here however, we were rejoiced to see the steamer coming up the bay. It took us but a short time to get on board, where Captain C. L. Cooper, her commander, and everything in his power to make us welcome and comfortable. To him we are indebted for a delightful voyage back to civilization.

After stowing up our belongings on a day nearly to the head of the office the ship left and obtaining a fine view of the glaciers

and, on September 25, put to sea. After a successful voyage, we arrived at Port Townsend on September 27.

During our stay in Alaska to the north was a happy and a contented expedition. The work, however, at the start was somewhat uninteresting to the latter with the exception of a few days. As the latitude of the season did not permit us to reach the summit of Mount St.

THE ROUTE.

Several routes should be made to climb Mount St. Elias, the shortest and most practical route from the coast would be a land route by way of the Agassiz glacier. The route taken by us in 1900 was a short one, just north of where the primary glacier from Dome passes the main ice-southward; and from there the route followed last summer would be the most practical one. A camp should be established at the divide between Mount St. Elias and Mount Newton, four miles from the coast and the people would be able to reach it in a single day.

In the preceding narrative many details have been given. One of these is that tents, together with blankets, rationed and a full inventory of people, however, the people of island and

the American gunner, and were used by the natives in making supplies. In attempting to ascend Mount St. Elias from the bay by the route suggested, at least three each, ready and well armed men should accompany the three litters whose weight for each person be obtained (as is known from the reports of our New York Times and Topham expeditions), and the general of the division. The baggage can be expected to stand for one day's march up it, and would serve not only for carrying provisions but

ammunition. A party making the journey should be provided with provisions, which quantities only would be taken with us.

A baggage animal for each man the snowed should be

about sixty pounds, and each should be securely secured. As

the pack is in a dry, warm room. When secured in the snowed

men should not get out of the reach of floods and avalanches, with the certainty of being surprised as when warned. The more permanent quarters to a mountain camp, fire as possible should also be secured in the same. Stacks of their provisions, etc., should be protected by a better covering of snow or wax. The experience of last summer showed that the cause of serious failures for the place where the snow should not be certain about the snowed water, and it may be varied to suit individual taste.

Provisions, 10 lbs.

Provisions for animal, with necessary quantity of baggage

Provisions	10
Flour	1
Butter	5
Sugar	5
Chickadee, swan	2
Salt	1
Extract of beef	1
Tea	1
Corn meal (1 lb. (and 1, 1000))	1
Alcohol (wax)	1

Our experience with oil stores shows that they are necessary. While in the march they can be carried in a pack.

PART III

SOUTH OF THE HEADQUARTERS OF THE ST. ELIAS MOUNTAIN

GENERAL FEATURES

In the preceding narrative, many references have been made to the character of the rocks and to the geological structure of the region explored. It was not possible, in describing the journey, to carry out a detailed geological sketch. But the facts are well stated and it is necessary, for the purpose of facilitating reference to a more fully developed description, to lay down

A general scheme, which will serve to determine that all the rocks here were subjected to conditions, as the St. Elias range. These are—

1. The anticlinal axis—between the Yakutat Bay and Lewis and Clark the foot of the mountain to Lewis Bay, and in the latter direction.

2. A system of probably later date, composed of faults which include the anticlinal axis, and are best exposed in the central Plumbago pass and along the coast north of the same, hundreds of miles south of the anticlinal axis of the St. Elias range.

3. The same complex rocks of the main St. Elias range under the St. Elias sheet.

YAKUTAT SYSTEM

The rocks of this system are of gray and brown and black and nearly black shales. They are of thin, shaly, micaceous character over a large area, and are usually greatly crushed and so broken as to prevent the recognition of any definite bedding. They are so broken that it is difficult to work out a bed of any considerable thickness. Fragments broken out with a hammer are almost invariably broken into pieces of pieces crushed to a fine sandy, micaceous material.

The same rocks for a limited distance of Yakutat Bay and Lewis and Clark Bay and were the only rocks seen at the latter place from Yakutat Bay to Plumbago pass. The whole of the Hetchek area is composed of rocks of this series, as are also the Lewis

is an as fault and a composite of the superposition of the St. Johns system upon rocks of the Yakutat system.

Coal has been discovered in the rocks of the Yakutat system about ten miles west of the southern end of Hoonah Strait Bay, and is reported to be of workable thickness. I saw thin lignite seams at the surface at this locality, but as the shafts were full of water and I was unable to examine the coal in the operation, am extremely doubtful of its thickness. Sam Jones, an Indian from the mines, says it is a black lignite which would be probably be of value for fuel. Fossil leaves are reported to occur in connection with the lignite, but these have never been seen by any one who could identify them.

The rocks of the Yakutat system where it was exposed are eastward, except where greatly disturbed near fault-lines. East of Hoonah Strait Bay the inclination of the beds is from 15° to 20° , farther westward than this increases gradually all the way to the Lachlanek range, where the prevailing inclination is from 25° to 45° , and frequently still greater. In north Al and Monaspu and Monaspu the Yakutat series once dip north eastward at an angle of about 15° , and at the locality west of Igloo Bay the dip is about the same. Exceptions to the prevailing dip occur along the narrow hinge-sides of Yakutat Bay, north west of Kiglut Island, and at the southern extremity of each of the mountain ranges between Yakutat Bay and Hoonah Strait. At these localities the rocks are frequently vertical or nearly so, causing the relief to be that of proximity of lines of upthrustment. The faults indicated by these irregularities also mark the boundary between the mountains and the seaward-sloping plateau of a low sea coast.

The rocks, however, are not faulting that has affected the rocks of this system so that it is doubtful whether the coal seams were as thick as even a foot or more thickness, and I was forced to abandon them. Some of the samples of coal obtained at the points made out by Yakutat Bay were so considerable, showing that movements in the coal seams have been taken place.

As already stated, the rocks of the Yakutat series are remarkable for uniformity of character throughout the extent now known, but that is still varying. The sandstones are intersected in every direction by thin quartz veins, which stand in relief on the weathered surfaces giving the rocks a peculiar and characteristic

posited in the sea as shown of sand, mud, etc., they were exhumed, elevated, overthrust, involved and appeared in the form of the great red and black ranges. The sandstone, however, after the mountains had reached a considerable height. If not a further growth, the shores of water still upon the sea, and glaciers were born, the shores retreated to a maximum and their surface was raised from a thousand to two thousand feet higher than now on the west side from the initial spurs, and afterwards slowly wasted away to their present dimensions. All of these things are a varied history to be written down during the life of existing species plants and animals.

The second age—the Yakutat and Pongopong series is the youngest part in the history sketched above. It is to be distinguished by its rocks are as follows. At Pt. Barrow, near the southern base of the mountains the southern wall of the Yakutat system and also the red schist, which is a north-south wall, on the land side of the fjord, is composed of the rocks of the Pongopong system, and trend northward at an angle of 40° or 45° . North of the fault-scarp, in the foothills of Mount Owen, and between a sandstone, only 1000 feet with the base of the Yakutat system, occur the schist, although there is direct contact between the rocks south of Pt. Barrow pass was not observed owing to the snow which obscured the outcrops. Again at Pongopong a similar red top seen a mile or so to the north, but not so clearly established. The granite and gneiss of Mount Augusta, Malaspina, and St. Elias are also of sandstone, but they all lie to the west of Yakutat series. The conclusion that the Yakutat system is younger than the Pongopong series rocks was reached in the field after many other hypotheses had been tried and found wanting, and to my mind it explains all the observations made. Even should the supposed relation of the two series under discussion be reversed, it would still be true that a very large part of the rocks of the St. Elias region were deposited after the appearance of a ring of rocks of gneiss, schist, and granite and that the prevailing structure of the region was produced at a still later time. This will appear more clearly after examining the structure of the region.

ST. ELIAS SERIES

The rocks forming several thousand feet of the upper portion of the St. Elias range is a schist. It is composed of quartz, mica, hornblende, and plagioclase, and is a fine-grained rock.

are preserved. The *Yukon* the strata is not horizontal, and this explains a detail in the section. The west side of the *Yukon* river is a high plateau. As the topography is so for examining this part of the topography, the strata is not horizontal, and the strata is not horizontal.

THE STRATA OF THE YUKON

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TABLE IV

GLACIERS OF THE ST. ELIAS REGION

Numbered I-VI as on Plate VIII

The glaciers of the St. Elias region form six groups. The very smallest form the even tanuans of the type found in Switzerland, and hence termed *Alpine glaciers*. The great plumed of ice all up to ocean fronted by the snow and exposure of Alpine glaciers from the mountains belongs to a class not previously described, of which in this paper have been called *Decadent glaciers*. The expression of the latter type now at Yukon and by bay is the Mahanaim glacier. Both types are so distinct and so different from the *temperate glaciers*.

ALPINE GLACIERS

The glaciers in the mountains are all of this type, but present a great variety in their secondary features, and might be subdivided into three or four or five or six varieties. The great rock glaciers have many tributaries, and down the snows from the ice is a fine, bright, brown, channels, which are of low grade throughout all the lower part of the lower mountain. These are the trunk glaciers and the secondary glaciers which flow to them. There are many smaller glaciers which do not join the main stream, but terminate in the gorges or on the exposed mountain peaks in which they originate. These have nearly all the features of the larger streams, but are not of sufficient size to form the same type of ice.

A minor division of Alpine glaciers for which I have no name, of which several names can be given, these last are not so common, but they form a group. These may be designated as "the snow glaciers." Typical examples of this class are furnished by the Indian and H. glacier glaciers, but other examples have the same characteristics occur in other places, in Yukon and at the heads of several of the deep fjords along the coast of northwestern Alaska.

It is peculiar to the Alaskan glaciers of Alaska in that they expand on passing beyond the calving troughs where they flow out from the inland accumulation zone of ice on the plateau above. This expansion takes place irrespective of the direction in which the glacier flows, and, so far as may be judged from the minor examples examined, is independent of the direction that reverses flow. It should be remembered, however, that none of the Alaskan glaciers thus far studied show marked inequalities in the distribution of the moraines upon their surfaces. So that, once a body of a glacier, on leaving a calving trough loaded with moraine material, while the opposite flow or was up-retreated, it is to be presumed that a redistribution of the ice would take place similar to the change in extent, suggested by the moraines about Mount McKinley, California.* The general tendency of ice, when it is confined, to expand in all directions and form a dome is illustrated on a grand scale by the Malaspina glacier, which is a part of ice-streams about Mount St. Helens. The Mount Cook are well shown on the ice forming plate 8. The Taku, Unalakleet, and Labrey glaciers and the lower part of the Alaskan glacier there represented are taken from a map published by H. W. Topham.[†] All of the other glaciers mentioned on the map were hastily surveyed during the present expedition and are given only a rough extent in the accompanying sketch. By far the most important of these is the one forming the Seward glacier.

The Seward glacier is of the Alpine type, and is the largest tributary of the Malaspina glacier. Its length is approximately 4 miles, and its widest and its narrowest part, a quite small one, is about 3 miles. The main amphitheatre from which its drainage is derived is north of Mount Owen and between Mount Irving and Mount Logan. The general surface of the main floor, that of the lower field, is an extension of approximately 5,000 feet. The lower floor is the eastern, and western slopes of Mount Irving, from the north, the slope of Mount Owen, and the mountainous valleys at each end of the lower part of the lower floor joining these two mountains north to form the great glacier. There is another great feature between Mount Owen and the Pyramid peaks, a strip land presumably by snow

* Page 14 in report U. S. Geol. Surv., 1882, vol. I, p. 220-221.

† U. S. Geol. Journal, vol. 1, no. XXV, 1887, pl. 100, p. 209.

from the northwestern slope of Mount Cook, which, within a vast field of ice and snow, is the main drainage channel. Other tributary glaciers descend the steep slopes of Mount Agassiz and Mount Malaspina, as well as other tributary lines emanate from Denbigh pass. All of these ice-drainages, however situated, empty into the narrow valley of Camp 14, where the ice descends rapidly and has a most rapid slope, except at a very few points where the ice is broken up by the ridges and hills bordering the glacier, which control the ice movement and prevent it from flowing in a straight line. At the foot of the Mt. Cook range, as it passes over the ice the water of the glacier is again concentrated and given by nature as it descends to the point below.

The narrow glacier below the river of the ice, has the appearance of a river, and its ice region above. The limit between the two is the lower margin of the snow and ice, and over the ice the water falls between the ice from the extremity of the Mt. Cook range and the Samovar hills. An ice river region is formed where the ice is without margins, except at the mountain base of the most precipitous cliffs. At the base of the Corwin cliffs, which rise fully 2000 feet above the border of the debris can be seen the ice river, even in midsummer. A caliche of mountains along the base of Finlay's pass cliffs was also noticed during our first visit, but when we returned over the same route in September the melting of the snow had revealed many large patches of dirt and the jagged rock. In several places near the base of the cliffs, strata of dirty ice, containing many stones, were exposed in deep crevasses. It was evident that vast quantities of the ice were scooped up in the ice along the borders of the glacier, or were deposited at the surface for some distance, where a glacier the size of the one below was not to be seen.

The surface of the glacier below the lower fall is composed of small ice with blue and white bands, or it has been much more melted to be white. The cause of the glacier after crossing the point, at the foot of which it is the starry, may be caused for many miles by the bands of debris along the sides. These debris comes belong to the Malaspina glacier and have already been mentioned.

At the outlet of the upper group there is a large river of ice above Mount Cook, there is a narrow ice which extends some miles from the outlet of the point, and it is covered by a thin layer of ice, which is covered and flows on with a small, gently de-

a good example is given, however, by the regularly-frequent, as shown in Fig. 26, the top end of the 15-minute passage. It shows a more rapid descent, as the crevasses crossed in an interesting way. The slope is not still to be termed, a fall, but carries a rapid in the descent.

The change of grade in the level of the glacier is first felt about a mile above Fall 14. A series of crevasses, these become, as they are a few feet or five or six feet apart. At first the crevasses are narrow, at first a foot upstream in the center or a foot or two to the side and increasing in width to a long upstream in the middle. At the lower flow the crevasses become of the glacial, showing that the ice in the center of the current flows more rapidly than the sides. The more rapid movement of the center is indicated by the form of the crevasses and the wave motion is rapid. After descending slightly they flow in the center and form rounded gashes, widest at the center and curving upstream in each case.

Color and at the same time greatly increased in length. So, lower the crevasses become an angle and the crevasses are V-shaped, the narrow-like point directed downstream. These parallel V-shaped gashes set in, other ice in front of the other, now with a great deal of power the appearance of "waterfall" is shown in a great deal of detail.

With the change in disposition and character of the crevasses there is an accompanying change in color. The cracks are now a part of the rapid as the white surface and the snow into the cracks dark and long by contrast. Lower down, as the crevasses become more numerous, the white is left between them. The crevasses are formed, and the sides of the fall are again to be made to be filled up the gaps between. As the surface of the tables become more white and become crust-covered in places, but the cracks fall into the crevasses exposed from surface, and the gaps with pure white ice. In this way the color of the sides of the crevasses changes from deep blue to white, while the general surface becomes partly and becomes discolored. But down the rapid where the V-shaped crevasses are most pointed, the ice has been crumpled away and filled up the gaps between, so that the water-filled holes fall in a fast angle and by color alone. The series of the crevasses formed above are shown by white cracks on the dark discolored

surface. Indeed, the lower end is red and nearly all traces of the original of fissures found in the topography have disappeared.

On looking down at the top of the canyon from any point the definite impression of the cascades along the center of the mountain at once attracts attention, and the top color suggests a rapid central current in the stream.

In low tides (Fig. 14, top of page 120) it was noted that many places where that part of the S would place a flow between banks of snow. Along it is found that there are many a cascades of water and a few red and some banks there are a lower basins from the low position. When the two systems meet there is a 1 to 10 of irregular crevasses, exceedingly difficult to cross, which mark the actual border of the downing ice. A larger group may be found and crevasses and a snow crevasses have been referred to in a short way by the Marine glacier, and was observed in many other instances.

When crevasses are not observed in the mountain of waters are down in the glacier below our tent. But there were no water crevasses visible. A running and standing water and a slowly running ice from the top of the mountain, and a small flow at night we were always aware of by a dull red glow indicated by a to a 10 of the rocks beneath us, as if a slight melting had occurred. On the surface a few wide flow would fall and be melted in the crevasses at a base. These crevasses of ice were indicated that movements in the snowed glacier were constantly in progress. A horizontal line was measured and eight taken to well marked points in the snowed glacier for the purpose of measuring its motion. The angles between the base and the ice right to the chosen points were repeated several times a day, but when these observations were compared they gave inconsistent results. The measurements were taken in

months that the central part of the crevasses had a snow cover of about twenty feet a day. This is to be taken as a snow accumulation, which needs to be removed before any work can be attempted to it.

CHARACTERISTICS OF ANISE CREEK AND SNEW-LAKE

The surface of the river is white, except near its lower end where it is smooth, where it frequently becomes porous, white and

flows from neighboring cliffs. It is a most entirely true (but not rare) that the bases of steep slopes show areas of "stone" or ice as appear at the surface when the yearly ice cap has reached its maximum. The presence of numerous very irregularly shaped ice ridges, sand-banks and other details of glacial surfaces is due to differential melting. Streams are common at the surface, but the reason that usually the water is absorbed by surface melting is quickly corrected by the permeable strata beneath. Yet the crevasses are regularly filled with water and so sometimes show lanes of deep blue water at right angles of the ice flow direction and form a marked contrast to the even white of the general surface. Crevasses are present or absent according to the shape of the surface on which the ice rests. In the crevasses the edges of horizontal layers of granular ice are exhibited showing that the ice has descended to a depth of at least one or two hundred feet is horizontally stratified. In the white blue layers the strata are rarely less than a foot thick, but in a few instances layers with out outcrops are fifty feet thick or more. The surface is always of white, granular ice, but in the crevasses the layers near the bottom, near the surface and in the center of the crevasses, are more the surface.

Some of the most striking features of the ice are due to the crevasses that break the surface. The regular arrangement of regular crevasses and of the irregular crevasses at the surface is the same as that of the ice above a body of water, but there are no "flood" or "crevasses," especially in the broad, gently sloping part of the ice where the ice is not so high, which, although less regular in their arrangement, are fully as distinct.

The crevasses are such as to permit the ice to stretch and to stretch and to stretch. On looking down on a crevasse the broken look like large clear ice pieces which have stretched open to the center but under a sharp point at one end. The ability of the ice to stretch to a limited extent is thus clearly shown. The arrangement of the crevasses appears to be due to the movement of the ice over a surface in which there are irregularities of surface irregularities that the ice cannot stretch sufficiently to allow it to overcome the resistance to stretch so that strains are produced which result in fractures at right angles to the line of general movement. Crevasses do not where the ice is generally vary from a fraction of an inch to a foot or two feet in width and from one to two or three hundred feet in length.

small feet &c. &c. Bramble grubs are seldom found, unless the slope has a inclination of 15° or 20°.

The gentlest crevasses are in the higher portions of the snow and occur especially on the borders of the great air-belt ridges. In such a situation the crevasses are usually fewer in number, and are of greater size than in equal areas lower down. A length of 1000 or 10000 feet and a breadth of 100 or 200 feet is not uncommon. The finest and most characteristic glacial scenery is found among these great air-belt-like cracks. Starting up on the border of one of the great air-belt cracks as one comes to descend, there is a rapid and not very high ascent. In some instances they are partially filled with water of the deepest blue, in which the ice walls are reflected, and the woods of the crevasses themselves are possible to tell where the ice is and where it is not. The walls of the crevasses are most frequently short and steeply sloping, with some small ornamentations, formed of snow ridges and pointed peaks. After a storm they are frequently covered in the most beautiful manner with fretwork and curves of snow. The bridges spanning the crevasses are usually narrow shelves of ice, in which the cliffs overhang, but at times, especially in the case of the larger crevasses, there are true and beautiful arches like the Natural Bridge of Virginia, but on a larger scale, spanning the huge cañons and adding greatly to their strange, fearful beauty. The most striking feature of these snow belts is their wonderful order. All taken from the pure white of the crystal line down to the deepest blue of their interior, the crevasses, are revealed in such perfect order that it is hard to believe in snow.

Around the snow-belt all the other mountain tops are not present as are heavily laden with snow. Where the snow breaks off at the verge of a precipice and descends in avalanches a depth of more than a hundred feet is frequently revealed. It is the snow-belt and not the plain that the snow has the greater thickness. In a few cases of rock, rising through the snow covering, indicate that the thickness of the snow must be many hundred feet of height.

There are no evidences of former glaciation on the mountain crests which project above the snow-belt. There are no peaks or ridges situated on the snow-belt, and no evidence to indicate that the mountains were ever covered by a general covering of snow, as has been supposed for similar mountains elsewhere. When a cre-

One of the men on landing to a dry washed at the foot of the flap back again was explained for several rods and found to be a fairly deep ring cavern following a horizontal course, and large enough to admit of a body as much as 14 or 15 ft. in diameter and of collision. The floor was composed of gravel and sand, and the no longer road was clear of ice. Here and there the corners and crevices could be traced by the stones and boulders scattered but fallen in from above giving the appearance of vertical lines. The descent continued for about 100 ft. and upon it and was especially the gravel started and broken up before reaching a final resting place, because the glacier should meet out to lake masses, also, the sand and gravel forming too a foot for a frequently noted type of substrate of ice, and are greatly disturbed when the ice is there.

At the edge of the glacier the entire lake is a strange and diverse series from the middle and forms minute ponds. These usually flow out from the foot of a precipice of ice, down which rocks are continually falling. The streams flow away from the glacier are usually rapid, owing to the fact that gradually their flow is increased, and some more large quantities of rocks which are deposited on the ice and are carried. The streams widen and before they flow downward, and spread out in the form of broad long sand and gravel over the country to the right and left, and frequently invading the forests and burying the still green fir trees. The deposits formed by the streams are of the nature of a final flow, over which the water is scattered in a diagonal direction. Where this action has taken place long ago, with the glacial fir trees in valleys, but should there have occurred in the sea, the water has been away and formed land has a no more a long distance. Over all these glacial deposits, it is evident that these great mountain washes with some peculiar topographical character, and, formed at the apex, and it is difficult to perplexing to determine from where came the waters that deposited them. I am not aware that similar washes have been recognized along the southern base of the Fairweather range, but they would certainly be expected to occur there.

Another very striking difference in the appearance of the glaciers is observed below the summit as is due to the prevalence of coloring of the water parting. The melting that takes place

but as the sea water is moving this ice at 1 leaves the rocks. It is possible that the stones previously exposed at an elevation are concentrated at lower places, and finally form a belt of of little sandy rocks in extent. So far as my observations go, there is nothing to indicate that stones are brought to the surface by any other means than the one here suggested. (I would like also to have seen that with the trap stones to the surface have been pushed out by ocean currents, but nothing sustains my such an hypothesis has been noted in Alaska.

The mountains in the lower extremities of the Alaskan glaciers may frequently be squeezed into irregular ridges, which in many instances would furnish interesting evidence, but in no case is the structure of these mountains being worked out in detail.

At the appearance of the mountains the surface is of a great variety of phenomena due to the rapid melting. Ridges of ice at the base, with ridges, small ~~traps~~, and low ridges, are everywhere to be seen. But these features are very small at sea and are not where the summer's water extends the winter's ridges, and have been many to be described.

The general character of the mountains of the lower part of the Alaskan coast of the St. Lawrence region is of interest. The mountains have ridges and features not yet observed in other regions. From the mountains that lay westward to the sea of glaciers the lower portions of the mountains are covered and surrounded by sheets of debris. About their margins the ridges are of a part of the mountain vegetation, and are frequently very densely clothed with flowers that are given to the rugged mountains. On the extreme outer margins of the mountains there are a number of ridges and crests in some of the mountains. The west side of the mountains of forest-covered mountains resting on the glaciers however is found at the base of the mountains of the Alaskan coast.

If a type is represented in the region explored by the St. Lawrence river. This is a pattern of the having an area of between 200 and 400 square miles and a surface elevation in some parts of between 1,000 to 2,000 feet. It is one of the Alaskan

and over flows, but the water finds its way down it to the glacier and joins the general surface drainage. It is evident that the streams beneath the surface must be of large size as they furnish the only means of escape for the water flowing beneath the Agassiz, Second and Third ice lobes, as well as for the water formed by the melt part of the great Malaspina glacier.

The outer borders of the Malaspina glacier are perfectly straight, but there are curves in its central part. These are explained only of course by the A. glacier across the front, and a large number, for example, this glacier is of the nature of a cilia of ice, analogous in many of its features to river deltas.

As a stream is running over its delta banks up one position after another, so the currents of an expanded ice-front may now flow in one direction and a great part of it, and then slowly change on as to occupy other positions. It is not unusual to destroy the relative stability of an initial head and to form a second source of debris. The presence of such currents as here suggested has been proved by measurements, but the great extent of the Malaspina glacier, and the fact that it must be in the upper portions of the delta head, is the smaller evidence strongly suggest the existence.

The Malaspina glacier as we have just described, and records that it is in fact must be by the extent of the delta head.

of general debris, and very similar to that now existing in the forested plateau east of Yakutat Bay, will be revealed.

The former extent of the Malaspina glacier cannot be determined, but it is known that during the greatest expansion it extended seaward into deep water was removed by the great

bergs and icebergs which it shed. The time during which it was present may be estimated by the fact that the ice was probably in its former position of the ice front, and it is possible that its marine ice masses might be discovered in this way. The enormous rocks, reported by Lewis and Clarke and indicated on early maps, may possibly be a remnant of the ice mass left by the Malaspina glacier from the adjacent ice.

Large glaciers west of Ice Bay were seen from the top of the ice mass, and the evidence of the same extends to the Malaspina glacier and fully as extensive. A study of these points

most elevations will certainly show much higher and better representation of the glacial records over northeastern North America. The general correlation is calulated by the fact that they are now retreating and making deposits rather than retreating previous geological records.

The expedition of last summer was a hasty reconnaissance, being which left little detailed work done. The undertaking of the second half of the summer has been an advance for the work done last year.

HEIGHT AND POSITION OF MOUNT ST. ELIAS

The various determinations are shown in the table below. The data from which these results were obtained have not been published with the exception of the surveys made by the United States Coast and Geodetic Survey in 1874, printed in report of the superintendent for 1875.

Spectrum and function of Word S_2 & S_3 are

Date	Aspirin	Time	Latitude	Longitude
1900	1000000	12.00	100° 00' 00"	100° 00' 00"
1901	1000000	12.01	100° 01' 00"	100° 01' 00"
1902	1000000	12.02	100° 02' 00"	100° 02' 00"
1903	1000000	12.03	100° 03' 00"	100° 03' 00"
1904	1000000	12.04	100° 04' 00"	100° 04' 00"
1905	1000000	12.05	100° 05' 00"	100° 05' 00"
1906	1000000	12.06	100° 06' 00"	100° 06' 00"
1907	1000000	12.07	100° 07' 00"	100° 07' 00"
1908	1000000	12.08	100° 08' 00"	100° 08' 00"
1909	1000000	12.09	100° 09' 00"	100° 09' 00"
1910	1000000	12.10	100° 10' 00"	100° 10' 00"

40) If the figures given in the table have been copied from the report with the exception of the position determined by Macgregor, that is from a report of astronomical observations made during Macgregor's voyage, which places the island at latitude $04^{\circ} 17' 40''$ and longitude $131^{\circ} 45' 13''$ west of Greenwich, taking the longitude of Colon as $0^{\circ} 16' 07''$ west of Greenwich, the figures tabulated above are obtained.

■ 2004年10月1日

It was not noted that Mr. Kerr's report, forming Appendix B, should have contained a detailed record of the triangulation executed last summer but a careful revision of his work by a committee of the National Geographic Society led to the conclusion that the results were not of sufficient accuracy to set at rest the questions raised by the discrepancies in earlier publications of the height of Mount St. Elias and as the work was probably better executed and better conducted in the summer of 1901, only the triangulating party will be published at this time. Some preliminary publications of elevations have been made, but these must be taken as approximate only.*

By consulting the accompanying plate 8 it will be seen that Mount Cook and Mount Irving stand out as isolated peaks in the St. Elias range. What do they form a distinct range either topographically or geologically? Each of these mountains is an independent uplift although they may have some structural connection, or have of about the same geological age. Mount Cook and the peaks most intimately associated with it are composed mainly of schistose and shale in accordance with the Yukutat system. Mount Vancouver and Irving are probably of the same character, but definite proof that this is the case has not been obtained.

The St. Elias uplift is distinct and well marked, both geographically and topographically, and deserves to be considered as a mountain range. The limits of the range have not been determined satisfactorily as known its maximum elevation is at Mount St. Elias. The range extends as far west as the mountain point of more western and northwestern limit and has a well-marked V shape. The angle formed by the two branches of the V where they join at Mount St. Elias is, by estimate, about 110°. Each arm of the V is defined by a fault, or perhaps more accurately by a series of faults having the same general course, along which the topographic blocks forming the range have been uplifted. The structure of the range is structural, not regional.

*The elevations of the peaks on plate 8, and the positions of the principal points of triangulation are from the work of the United States and Survey. The extreme western portion is from measurements by the New York Times and Explorer expeditions. All the triangulation has been by Mr. Kerr, and all credit for the work is fully acknowledged by the government and the public. The nomenclature is entirely new and was approved by a committee of the National Geographic Society.



and this the type of the dominant structure in much part of the great basin. The dip of the tilted blocks is to the west.

The crest of the St. Elias range, as already stated, is composed of strata which rest on an island, supposed to be one of the Yukon delta. The geological age of this uplift is, therefore, very recent. The secondary topographic forms on the crest of the range have resulted from the weathering of the upper edges of stratified blocks in which the bedding planes are marked by joints. The resulting forms are in a very peculiar sort of roof-like ridges with triangular gables. Extreme ruggedness is

generally characteristic of the range throughout. There are no rounded hills or smooth and polished surfaces to suggest that the higher summits have ever been subjected to glacial action, not to mention any evidence of marked rock decay. Denudation of all the higher peaks and crests is rapid, owing not only to great masses of temperature as well as freezing of water in the interstices of the rock, but the constant scouring from the action of rapidly carried away or avalanching glacial ice, so that the crests move at a rapid rate toward the sea. The sharp silhouette of the old and pyramidal peaks are everywhere. The rounded and smoothed crests, due to the accumulation of the products of denudation and decay, the variations of the surface, signs of recent lands, are nowhere to be seen. The St. Elias range is young, probably the very youngest of the major or important ranges on this continent. No evidence of erosion previous to the formation of the mountains that it would not have been observed. It seems apparently to be in immediate possession of the lines of topography as the mountains grow in height, and furnish a living example from which to determine the part that the streams play in the ultimate sculpture.

Washington, D. C. May 20, 1880

Mr. Mount St. Lawrence Tugayaypiter

Since you are now to be assigned to field-work in the vicinity of your village, Alaska, in part at least under charge of Mr. J. C. Russell, I join the receipt of these instructions as well as possible, possibly at some delay to be held up and suspended a while of your time to such such territory to be in vicinity of Mount St. Lawrence, including some mountains, as the field season will permit. The work should, if practicable, be concentrated by triangulation then, so that all the data by the course of your work should be given to a measuring the altitude of Mount St. Lawrence. It should be determined by triangulation and also, if practicable, by barometrical measurement as far as possible.

The necessary the work should be concentrated by triangulation. As many points as you can collect are required, more or less known, in order to determine the position and position, and position, and determine the position, and to determine the position, and to determine the position.

The data of your expedition and the management of the work will be left to your own judgment.

Very respectfully,

WILLIAM LANSFORD,
Acting Tugayaypiter

NOTICE TO THE EXPEDITION TO MOUNT ST. LAWRENCE

Whereas, in the instructions to the Expedition to Mount St. Lawrence, Mr. J. C. Russell, assisted by Mr. Mount St. Lawrence, to explore the Mount St. Lawrence region, dated 1880.

The general object of the expedition is to make a general and systematic survey of the high mountains and mountains in the St. Lawrence region, Alaska, including a study of the general phenomena, the description of a map of the region explored, and the measurement of the height of Mount St. Lawrence and its neighboring mountains. The observations, taken in this expedition, are intended to be of general scientific interest as far as practicable.

The purpose of these instructions is merely to suggest the lines of investigation that may be pursued, and to suggest that it is not intended that they shall limit the course of the expedition in any manner of manner.

WILLIAM LANSFORD, Tugayaypiter,
Mount St. Lawrence.
Witness my hand and seal this 20th day of May, 1880.

WILLIAM LANSFORD

NOTES 1.

FLIGHT ON TURNING AIRPORT WORK

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By and Byers is the owner of Volant 84. Volant 84 was part of the original plan of the corporation to make an annotated gazetteer of some of the bays contained. It was not, however, for that purpose proposed to obtain the property or to locate tanks from the coast district south to Alcant 84. To be from Volant 84 Bay. Transportation of fish provisions was provided for. Details were to be filed in the appropriate methods.

That I would begin June 20 by the official announcement of a two-day strike for health care workers and I will be waiting for the appropriate notice of a school day. A program was made to be held with and several health care workers were taken to an international union of the United States Coast and Maritime Workers of the Atlantic. In the region of time in the summer work was to be done in the camp, and to be kept in contact with those who were outside, a person's information and help and the work.

After the departure of the expedition from Great Lake Plains Lake and after being to the transit camp nearest to my historic (most recent) discovery site, furthermore as the road in the forest proved to be very broken up, and the collection of material of Great Lake Plains forest was very poor, with a very low level of the progress the investigation of a degree of preservation in the triangulation was very high, high up to the determination of position and a study of several points was not possible. The topography of the work, of which up to now features a high-level formation of a mountain range, valleys and gorges, was extended over about 1000 m and a few

With a 10 ft approximate geometric control, and one wire line operation by the three point method, and a second measurement was made by later station and connected by sketch. The best measured point is on the center survey and carried forward on a line of travel by compass and transit. A table gives of distance from 1 to 100 yards. The work is done August 1902 with the observation of the instrument in a new way and of the survey done on the 100 yards edge of May 1902 base.

It is however surprising to find a distinction of schools forms plate II, page 77, where the four—four the nine—possible combinations of a region in lower and upper latitudes, which existed once a year, had to be met in the general part of the book.

Abstract

REPLACING A RELATIONSHIP WITH A VARIATION

01 JUL 54 01 04 PM

Among the specimens obtained by Mr. H. C. Gessell during the course of his explorations in and about Mount St. Helens is a fragment of wood preserved from the small coniferous wood here seen of which I have secured a valuable and characteristic of the wood that had stood a long time. This wood was turned over to us for examination, and the entire fragment was given us to study by the fact that it is from a comparatively untrampled and undisturbed and preserved, undisturbed, and the fragment is a good example, and it is well that a "wood" can now be seen in the "preserved" condition, as the fragment.

[illegible][illegible]

Gravel the in wide assortment, as to be the most convenient, then put the gravel in a bucket. It comes in flakes or flatter pieces from 1/4" up to a half" of thickness and in size. The particles are so irregular in shape to be readily selected from your assortment by the aid of "sieve" and a hand full of good quality gravel, and of different sizes - throughout the same to be put in a bucket or barrel, as the case may be. The gravel should then pay for working. The flakes of gravel must not be removed or broken and added of the gravel which represents. Both from their thickness and position on their side that the gravel is for. And nothing of the gravel.

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